European University Institute
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Marxism and Ecology
A Study of the relationship between nature, society and technology

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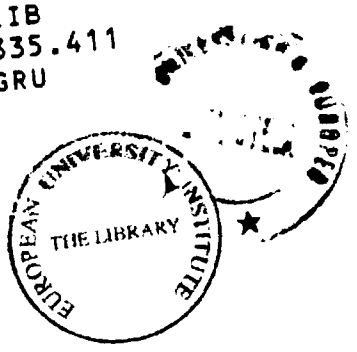
Thesis submitted for assessement with a view to obtaining the
Degree of Doctor of the European University Institute
of Political and Social Sciences
Florence

July 1989

European University Institute
Department of Political and Social Sciences



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July 1989

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Acknowledgements

In the process of writing this thesis, several persons have been of great help to me. When I first came to the European University Institute, the Department of Political and Social Sciences did not have much interest in the type of theme in Political Theory which this work addresses. It was Wolfgang Streeck who - as a visiting Professor at that time at the Institute - helped me most in defining part of the scope and method of my work; and it was he and Werner Maihofer who discussed early sketches with me. Professor Maihofer also drew my attention to several philosphical topics such as the significance of the "young" Marx and the relationship between Marx and Feuerbach. Apart from that, he helped me in sustaining my morals and in contacting experts on Marxism and Marxology. On several occasions, although still in an early period of writing, I profited from discussions with Iring Fetscher in Frankfurt. A decisive turn in my work occured, however, after the arrival of Steven Lukes at the Institute. His presence, his seminars and the discussions on draft versions of the manuscript have stimulated my thought, forced me to state my argument in the clearest way I could, and to conclude the work in a reasonable time limit. Working as a research assistant for Gunther Teubner has brought me into close contact with some new paradigms in the social sciences; I also had the pleasure and opportunity to learn a lot from him in private discussions, seminars and conferences. Finally, I would like to thank Andrew Clapham, Peter Kenneally, Sean Smith and David Thomas, who all read parts of the thesis and helped me improving the English. Paul Kearns edited the whole thesis and provided me with helpful suggestions. Needless to say that I am alone responsible for errors still remaining, be they of grammatical or stylistical nature.

INTRODUCTION

It seems to be commonly accepted that Marxism has little to say about ecological problems, that its implicit positions far from illuminate them, and, what is more, that the Marxist position enables, causes or legitimizes harm to the environment. The present work proceeds to a thorough reconsideration of any such assumptions.

But it also appeals for the obviation of such simplistic approaches as are typified by a leading Marxist economist, Ernest Mandel: "The evil is private property and competition, that is, the market economy and capitalism. All catastrophes, including the irrational and inhuman roads that technology is led down, derive from this social base and from it alone." (Mandel 1975:16) In a similar vein, albeit more careful, Cohen writes that "whatever the size of the problem would otherwise be, it is certain that capitalism aggravates it." (Cohen 1978:322)

To understand the meaning of the ecological discourse, it might be helpful to look back to world-views of the last century. A common world view of the 19th century was that the growth of scientific knowledge, technological development and economic activity, in a word, "industrialism" was an inherently positive thing because it served human purposes. The 20th century saw the results of this unbounded productivism; it became manifest that although mankind succeeded in gaining more wealth, the natural environment became more and more debased, which in turn was detrimental to human well-being. With this observation, it took little to conclude that productivism was responsible for this unpleasant state of affairs. Since human beings prosper at the expense of nature, so goes the claim of many environmentalists,

they do not take into account that this debased nature will not allow mankind to prosper or survive in a not so distant future.

But there are also authors, whether Marxist or not, who claim that Marxism is of little help in investigating ecological problems. Anthony Giddens, for example, writes that "[i]n Marx, nature appears above all as the medium of the realisation of human social development. The universal history of man is traced through the progressive elaboration of the productive forces, maximised in capitalism... But Marx's concern with transforming the exploitative human social relations expressed in class systems does not extend to the exploitation of nature." (Giddens 1981:59) Giddens concludes that this "Promethean attitude" is indefensible in the twentieth century since "the expansion of the productive forces can no longer be treated unproblematically as conducive to social progress." (Giddens 1981:60) But Giddens confuses expansion of productive forces "as such" with productive forces which are detrimental to the natural environment. This may be a mere verbal quarrel. However, it seems that in his terminology, the expansion of productive forces leads inevitably to an "exploitation of nature". While I think that nothing is wrong with "exploiting nature", there is certainly something wrong with nature transformations which lead to worse life-conditions of human beings. In other words, I think that the "Promethean" attitude is not only defensible, but also superior to Giddens' suggestion that Marx should have extended his concern to exploitation of nature.

It is true that Marx welcomed the growth of productive forces and, what is more, praised even capitalism for developing the productive forces in a hitherto unknown way. Thus, at first sight, industrialism for him was part of the historical tendency of the productive forces to develop - an indispensable condition for the advent of a communist society. This outline has been summarised by André Gorz in the following way:

> Until recently most Marxists still thought of forces of production - in particular science and technology - as ideologically neutral, and they considered the development of these forces of production to be inherently positive. They usually held the view that as it matured capitalism was producing a material base on which socialism could be constructed, and it was thought that the more the forces of production developed under capitalism the easier it would be to build socialism. Such productive forces as technology, science, human skills and knowledge and abundant dead labour (fixed capital) were considered to be assets that would greatly facilitate the transition to socialism. (Gorz 1976:159)

But Gorz does not share this view; on the contrary he thinks that modern science and technology are "ideological" in the sense that they are shaped in decisive ways by capitalist interests. Indeed, there are several authors who deny that there can exist something like "innocent" productive forces. As we shall see, this question is a crucial one for Marx's own analysis. This discussion will lead to the result that we must be aware of a double meaning of the term "growth of productive forces": it can mean (1) increasing mastery over nature and (2) production of wealth (material goods) with ever diminishing effort or in increasing abundance. The first meaning is that mankind gains an ever greater mastery over nature, in the sense that individuals develop into universal human beings, that they <u>expand</u> their control over the world around them, that they are able to shape a world according to their needs and pleasures. Let us call this the "philosophical meaning". The second meaning is primarily economic; a growth in this sense can be measured with economic criteria of efficiency. Let us call this the "economic meaning".

Both meanings in Marx are linked together. The dignity of human beings requires freedom from hunger as much as it does freedom

from a hostile nature which acts upon them as an alien force. For Marx two alternatives are thus excluded: first, to accept modern civilization in which detrimental effects stem from man's transformation of nature, and, second, to go back to a state in which the well-being of people could not be secured on the material level. Marx's position was a plea to expand human power and control over one's life-conditions to such a degree that the release of all human powers would lead only to beneficial consequences.

A critique of Marx can only start at this point. If there is any basic flaw in his treatment of productive forces and the domination of nature it is in the insufficiently clear distinction between the growth of productive forces and increasing mastery over nature. Marx, at times, seems to assume that the former does imply the latter. Against this I argue that there may be productive forces which do not lead to an increasing mastery over nature but, rather, to an increasing uncertainty, risk and uncontrollability as well as to unnessary oppression in the production process. However, we may find in Marx also an implicit distinction between these two meanings if we look at his awareness of the shortcomings of a purely economic approach. This awareness leads him to a radical opposition to the Political Economists who thought that capitalist market economies would maximise economic efficiency and thus human welfare and happiness. His attack on Political Economy thus embraces both elements: it offers arguments against the efficiency claim as well as arguments against the maximisation of human welfare and happiness, for capitalism is an irrational form of enhancing efficiency (crises!) and it decreases happiness. It only creates the material preconditions for a real human society. If this reasoning is true, Marx does not equate increases in economic efficiency with an increase of human mastery over nature.

But some critics of industrialism go one step further: they make the basic claim that the development of productive forces per se is incompatible with the prospering of nature. From this proposition they conclude that industrialism should be limited (or even abolished) in the interest of nature and mankind.

Although Marx rarely adressed ecological problems, this much is clear: he sharply opposed such pessimism. Instead of assuming the basic incompatabilty of modern technology with the prospering of mankind he assumed - at least in Capital - only the basic incompatibility of modern technology under capitalist relations with the prospering of mankind. He thus assumed, in contradiction to the critics of industrialism, a basic compatibility between modern technology and the prospering of mankind. As my analysis will show, this judgement by Marx does not stand up to the empirical evidence. The 20th century has seen a rapid development of productive forces which has been partly enhanced by public enterprises or by socialist enterprises (i.e. enterprises in socialist countries). In both cases the damaging effects did not disappear (as we might expect on the basis of Marx's prediction). On the contrary, it seems that socialist countries present an even worse ecological record in comparison with capitalist countries.

Does this invalidate Marx's analysis? Are we to abandon his framework since the empirical facts have (once more) belied his predictions? My answer is no. One reason is that he analysed the implications of machine-technology (above all in the recently published Manuscripts 1861-3) and was aware that the technological structure of capitalism - not only the capitalist use of it - may be detrimental for "the good society". Another reason is that Marx's prediction, based on the concepts of the critique of Political Economy, may have been falsified, though not necessarily other parts of his theory. In investigating more deeply the

philosophical argument, this work is also distinguished from some attempts at "reconstructing" a "green" Marx, a procedure which usually rests on a compilation of apparently "green" statements by Marx (cf. Schmied-Kowarzik 1984). One of them is the famous passage from the Paris Manuscripts where Marx spoke of a "humanization of nature and naturalizing of man", which is usually interpreted as the young Marx's desire to bring about harmony between man and nature. In my view, such ad hoc "reconstructions" of an "ecological Marx" do not reveal interesting insights. For we all know that Marx was no ecologist, even if he could have been one.

But still, the philosophical Marx may reveal fundamental and illuminating insights. Marx's theory, after all, aims at human emancipation. If we forget this, Marx was not much different from an economist who measures human wealth in terms of prices and per capita income. Marx's lifework consisted mainly in showing that capitalist economy is a state of affairs in which individuals are systematically unable to control the outcomes of their actions. Such a critique highlights economic crises, but also "business as usual" and its reification of social relations. Crises, alienation and fetishism affect all memebers of capitalist society, i.e. capitalists, too, are caught in a situation "unworthy of their human nature". Post-war prosperity and interventionist techniques of the Welfare state in the economy have led many to believe that the basis for a socialist critique of capitalism has vanished. Yet many Marxists and Marxologists feel that the range of Marx's theory is not exhausted by the fact that capitalism has brought about considerable economic growth. The decisive reason why Marx's theoretical range is wider is because he stresses the need for human control over its fate. This is to say that, even granted that capitalist economy works smoothly (which may still be doubted on good grounds), there may be other respects in which human

control has not been established. Only if such a control is improbable, implausible or even undesirable, we would have reasons to oppose the underlying logic of his critique of capitalism.

If we turn away, then, from Marx's political economy, and enter his philosophical discourse, we encounter, first, the abstract relation between man and nature, as a transhistorical condition, and then the specific historical forms which this relation assumes. Technologies serve as criteria to distinguish such historic formations. Needless to say that in this respect Marx is equally concerned about people's ability to understand and control the world around them. Certainly, Marx as a writer of the 19th century was rather optimistic as regards the possiblities of science and technology in this process. But again, although his expectations have not been fulfilled, we should not prematurely dismiss his theoretical outline. On the contrary, if science and technology have not been instruments for mankind to shape a world which is intelligible and controllable, we still live in conditions which have to be superseded in order to achieve human emancipation, a task in which Marx's theory may be of help. Whether or not this will yield valid or feasible solutions, it will articulate the ecological problems of industrial societies from his philosophical framework. This framework is a unique combination of various modern philosophies, such as Bacons', Kants', Hegel's, Feuerbach's and others. In sharp contrast to this, the discourse of fundamentalist environmentalism proposes to industrial societies that they adopt "a simpler life" in order to safeguard the survival of this planet. If the ecological challenge is a challenge to basic assumptions of modern thinking, let us see, then, to what use one version of the modern view of nature, viz. the theory of Karl Marx, can be put.

To summarize: two expectations of Marx have been disapproved: the expectation that science and technology would create an intelligible and controllable world as well as the expectation that only capitalist relations stand in the way of such a goal. But equally wrong are the environmentalists who foolheartedly believe that the basic fault has to be seen in the attempt to harness nature to human purposes or to develop productive forces. I argue that some productive forces may run counter to the aim of extending human control over nature. This study therefore investigates the conditions under which modern technology is developed and applied (chapter 3). If the growth of the productive forces does not lead automatically to an increase in mastery over nature, we also have to reconsider basic assumptions of historical materialism (chapter 4). A reformulation of basic assumptions of historical materialism will inevitably affect our understanding of what communism is, or should, be (chapter 5).

Alfred Schmidt in his pioneering study has already remarked that we have to collect many scattered remarks from a wide range of Marx's theory, since Marx never treated the concept of nature in a separate discussion. These scattered remarks, put together, open up a complex discourse, since its elements are interwoven in many ways. There are many possible connections with other elements of his theory or with the theories of others. This could take us to philosophy, natural sciences, history, epistemology, political economy, sociology, and further afield, where there is considerable danger in being distracted from the centrally important discussion. For this reason, I have largely excluded questions of epistemology, political economy and history from this study, giving preference to an approach which locates Marx in a philosophical tradition and connects his thoughts to contemporary social theory and interpretations of his work.

CHAPTER 1: ESTABLISHING PHENOMENA, CLAIMS AND EXPLANATIONS

> Gemäß der Natur wollt ihr leben? Leben - ist das nicht gerade ein Anders-sein-wollen, als diese Natur ist? Ist Leben nicht abschätzen, vorziehen, Ungerechtsein, Begrenzt-sein, Differentsein-wollen?
>
> Nietzsche

Since the first studies concerning ecological problems have appeared[1], the topic has been an ever-present issue in many contemporary debates. These studies were alarmist in tone. They led to a debate which altered the political discourse in one important respect: the natural environment became an issue for political activity, for political parties and for governments. It became an issue for social and political sciences, for economics, moral philosophy and law. Other parts of society increasingly realised that environmental questions were crucial; but just <u>how</u> crucial

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1 Carson (1962); Meadows and Meadows (1972). See the criticisms of Heilbronner (1973), Myrdal (1973) and Galtung (1973) with respect to the latter.

turned out to be a topic for many debates. These debates are still going on, with the notable change that more recent studies have abandoned the alarmist tone and try do distinguish the problems more precisely.[2]

1.1. Phenomena

It is worth noting that the 'early' reports on environmental problems were stressing the interconnection of several factors which would lead to an ecological crisis or collapse. The most important of them being exhaustion of resources, population growth and pollution. At least in respect of the problem of resources and population, recent studies, such as the Commission of the United Nations on Environment and Development, are more optimistic.[3] The most recent report of the commission (1987) lists the following phenomena:

1 pollution (air, water)
2 depletion of groundwater
3 proliferation of toxic chemicals
4 proliferation of hazardous waste
5 erosion
6 desertification
7 acidification
8 new chemicals (cf. World Commission, 1987:10)

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2 To be sure, there is also less need today for alarming the public than there was 10 or 20 years ago; Three Mile Island, Tschernobyl and Bhopal established an ecological awareness which no alarming study could have accomplished.

3 "The commission believes that widespread poverty is no longer inevitable" (1987:8) "Global agriculture has the potential to grow enough food for all, but food is often not available where it is needed." (ibidem:12) "Hunger often arises from lack of purchasing power rather than lack of available food." (ibidem:13) Note that the depletion of natural resources does not figure as a separate theme in the report.

In a quite illuminating but little discussed book, Passmore listed the following problems :

(9) pollution
(10) depletion of natural resources
(11) extinction of species
(12) destruction of wilderness
(13) population growth (cf. Passmore 1974:43)

Since 1,3,4,7 and 8 are contained in the more general(9), I shall take Passmore's list as basis for further discussion. Since (11) and (12) are contained in (10), we have basically pollution, depletion of (renewable and non-renewable) resources and population growth as ecological problems.[4] Population growth can be an ecological problem in two senses. First, it can be seen as leading to ecological problems such as pollution or depletion of resources, because an increasing population might require more intense exploitation of resources or more technological development with pollution as a side-effect. Second, it can be seen as an ecological problem per se, i.e. the increasing number in a specific place may be detrimental to human well-being. Taken in the first sense it is a cause of, taken in the second sense it is an instance of, an ecological problem.

The issue has a practical and a theoretical dimension. The practical dimension is that almost every country has been affected by ecological problems in a more or less significant way; it has become one of the central political questions in the course of a few years. Social movements have come into being in many countries

4 Erosion and desertification fall out of the list. They are natural processes anyway and interesting in our context only in so far as they are caused by human intervention. In this case we might classify them under (10), distinguishing between renewable resources (agriculture) and non-renewable resources. Side-effects of chemical substances (such as pharmaceutics) would have to be included under pollution.

industrial societies. Utopian projects have to acknowledge the highly complex character of modern technology if they want to bring about feasible changes. Marcuse, posing himself this problem, thought that there could be two types of mastery over nature, a repressive one and a liberating one. To this position Habermas quite rightly objected

> "that modern science can be interpreted as a historically unique project only if at least one alternative project is thinkable. And, in addition, an alternative New Science would have to include the definition of a New Technology. This is a sobering consideration because technology, if based at all on a project, can only be traced back to a 'project' of the human species as a whole, and not to one that could be historically surpassed." (Habermas 1971b:87)

Analysing contemporary ecological thought, Oechsle found that a common world-view prevalent in it is naturalism. Naturalism, according to her, proceeds in the following way. It first juxtaposes nature and society; they are seen as standing in contradiction to each other. It then tries to solve this contradiction in such a way that society adapt its laws to the laws of nature. "Naturalismus meint hier den Versuch, die Gesellschaft von bestimmten Gesetzmäßigkeiten der Natur her zu erklären und zu verstehen, gesellschaftliche Organisationsprinzipien und Normen des Zusammenlebens aus ökologischen Prinzipien abzuleiten und zu begründen." (Oechsle 1988:9) Haeckel (who coined the term "ecology" as denoting the science which analyses the relationships of organisms to their environment) had already claimed that man should lead his life in accordance with natural laws. It is intriguing to see that this naturalistic world-view is a common denominator of all political tendencies in the ecological discourse. We find it in conservative authors like Gruhl (Gruhl 1975:33,345); in communist-stalinist authors like Harich (1975:161); in anarchist writers like Bookchin (1977:15), and in eco-socialist writers like Lalonde (1978:53). All of them claim the authority of nature and her laws to be the foundation stone of

a new society which will solve ecological problems. Gruhl and Harich are alike in that they stress the iron necessity with which nature operates; from this they derive similar tough political measures. Bookchin argues that spontaneity in life converges with spontaneity in nature (1977:10), and Lalonde stresses the fact that nature is and society should be self-organizing. This short overview shows that nature seems to be an authority which many think to be uncontested; however, as closer analysis shows, each version of nature is a construction of their authors. Therefore, what the "nature of nature" is, is a matter rather of debate than certainty.

This already makes clear that any discourse on nature and ecological problems is not without presuppositions; and these presuppositions lie within the cultural background of the participants of the discourse; they are are product of history. A definition of "nature" or of ecological problems, therefore, always relates to an anthropocentric element. Now, how does this anthropocentric element relate to the domination of nature? Oechsle rightly defends man's special position within nature; and she rightly refuses ecological naturalism. However, she does not defend it in a straightforward way which she - in my opinion - should have done. In my view, man's special position within nature is characterized by his dominating of nature. In order to separate the question of whether mankind has a special status within nature from the question of whether mankind should dominate nature, Oechsle (approvingly) cites Mumford, who claimed that within occidental civilization there have been examples of a "democratic" technology. This argument gives her the possibility of defending a sort of anthropocentrism without embracing the notion of domination of nature. However, a distinction between a democratic and an authoritarian technology makes sense only with respect to man, not with respect to nature. Every technology, even the softest, forms

a part of man's domination of nature.[6] Oechsle agrees with authors like Amery, Bahro and Meyer-Abich (inter alia) that we have to research the origins of destroying nature. These are seen in the specific occidental human self-understanding and world-view. As Amery put it:

> "Werden die Wurzeln dieser historischen und ideellen Haltungen nicht freigelegt, werden die notwendigen Vorschläge immer auf politischen und gesellschaftlichen Widerstand stoßen, und nur wenn man sich klarmacht, wie tief diese Wurzeln in unseren kollektiven Untergrund hinabreichen, wird der notwendige, das heißt der radikale und höchst schmerzvolle Prozeß einer planetarischen Revolution ... eingeleitet werden können." (Amery 1976, cited in Oechsle 1988:96-7)[7]

Human beings have no fixed place where they have to live; virtually every place on this planet can be inhabitated by them. By this they distinguish themselves from most other animals (and, of course, plants) who survive only within a limited geographical, biological, climatic zone. How are human beings able to survive in an "insecure environment"? The answer is: by constructing a second "nature" around them.[8] This artificial, man-made nature is the embodiment of their necessity to fight against nature; it is the solution of the apparent paradox that they are in and against nature. The solution of the paradox entails a wholly new dimension

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6 Oechsle comes close to acknowledging this when she writes that even the most "dialogical" approaches towards nature (as, for example, proposed by Prigogine) cannot but lead to a more perfect domination of nature. In Trepl's words: "Ökologische Technik ist der totale Zugriff. Daher steht auch die Ökologie nicht außerhalb der Logik des Fortschritts, sondern dieser kulminiert in ihr." (Trepl 1983:11)

7 But at the same time Oechsle defends the anthropocentric world-view to a certain degree. Man is Natur und Übernatur, is part of nature and at the same time "above" or even "outside" nature.

8 In comparison, an animal species in an unfavourable environment will undergo an evolutionary process in order to survive.

by which human beings distinguish themselves from animals: it is the use of tools or technology.

But something further follows from this. Because human beings are organizing their life in the described way, they have no "natural enemies" as almost every other species has though, certainly, they have sometimes specific parts of nature in opposition to them, nature which exerts its resistance upon them. As James Stuart Mill observed, the powers of nature "are often towards man in the position of enemies, from which he must wrest, by force and ingenuity, what little he can for his own use." (Mill, 1904:15)

This stresses again my objection to the ecological world-view which challenges the anthropocentric world-view. Nature, as such, is not always beneficial for human beings. It is completely mistaken to identify nature with 'good' and technology or human culture with 'bad'.[9] Moralizing helps rarely, less so with respect to nature. As Passmore observed quite rightly, "these natural processes may in fact be quite harmful, so that, let us say, oysters from granite regions ought to be condemned for human consumption. The 'natural' is not necessarily harmless, let alone beneficial to man." (Passmore 1974:47)

In exactly the same vein, Adorno, reflecting on the landscape of the Swiss alps, remarked:

> "Both, the scars of civilization and the untouched zone beyond the timber line, are contrary to the idea that nature is a cheering, warming thing, dedicated only to man; it reveals how the cosmos looks like. The usual imago of nature is limited, bourgeois narrowly, sensitive only to the tiny zone in which historically familiar life flourishes; the

9 As Kluge has shown in detailled study, much of the ecological rhetoric consists of the juxtaposition of life and death - where nature stands for the former, industrialism for the latter (cp. Kluge 1985).

> bridle path is cultural philosophy." (Adorno 1968:327, my translation, orig. emphasis)

Passmore, in reply to Barry Commoner's "Third law of ecology - nature knows best", pointed out:

> "It is true enough... that every human intervention in an ecosystem is likely to disturb the workings of that system in a way that is detrimental to some number of it. So much is true of every change, man-induced or nature-induced. But it by no means follows, as his 'law' might seem to suggest, that every such change, or even most such changes, will be detrimental to human beings. Unlike the watches to which he compares them, ecological systems were not designed for man's use. When men picked seeds off plants and sowed them on cleared ground, they acted in a way that was detrimental to the organic life which was accustomed to feed on the fallen seeds. But only the most unreconstructed primitivist would suggest that the actions of our agricultaral forefathers were destructive of human interests. A nature left entirely alone as 'knowing best' would support only the dreariest and monotonous of lives." (Passmore 1974:185)

The anthropocentric approach[10] has the main virtue of offering a reference point from which to evaluate ecological problems. The reference point, as we shall see, can be defined in different ways (presently living human individuals, society, mankind, future generations) but no matter how we define it, it firmly establishes a clear criterion of how to judge existing ecological phenomena. Any 'eco-centric' approach, on the other hand, is bound to be

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10 To avoid misunderstanding, my use of the term is that which is synonymous with 'humanistic'. In so doing, I try to avoid any connotation with the Rennaissance-view which saw man at the centre of the universe. See Pico della Mirandola for a typical formulation of that time. (I am indebted to J.P. Cavaille for this reference.)

inconsistent, unless it adopts a mystical standpoint. It is inconsistent because it pretends to define ecological problems purely from the standpoint of nature. It starts with assumptions about nature and natural laws to which all human action should adapt. [11] But it is evident that the definition of nature and an ecological balance is a human act, a human definition which sets an ecological balance in relation to man's needs, pleasures and desires.

Consider now the following claims:

(C1): Ecological problems are the result of man's domination of nature.

Following from this, another model of man's relation to nature would eliminate ecological problems. The alternative model would be communicative instead of dominating. 'Harmony', 'convivality' and 'cooperation' would be the underlying principles (cf. Bloch 1959; Illich 1973; Bateson 1982). This claim having already been criticised above, let us turn to the next one:

(C2): Ecological problems are basically the result of man's destruction of nature.

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11 Note that the refusal of anthopocentrism is followed by a conspicious position which anthropomorphises nature, i.e. it projects human standards and inventions into the working of nature. But why should nature work in a 'balanced' manner? Or why should nature always be beautiful? Is it not man who introduces laws of beauty into nature? Cf. Kundera: "Ohne es zu wissen, komponiert der Mensch sein Leben nach den Gesetzen der Schönheit, sogar in Momenten tiefster Hoffnungslosigkeit." (1984:52) and before him Marx in the Paris Manuscripts: "Man forms objects in accordance with the laws of beauty." (CW 3:277)

This definition releases us from the difficulty of alternative modes of conceiving and treating nature. (C2) does not necessarily refuse the domination of nature; it only opposes some extremely negative features ('destruction').

However,this claim is equally misleading because it suggests the (false) belief that nature could be destroyed (by human action or otherwise). As is clear, this definition leads us immediately to metaphysical arguments and to the idealism-materialism opposition. Interestingly enough, many of the participants of the ecological debate are 'materialists' (virtually all natural scientists) and therefore should not believe in the possibility of nature's self-destruction, and, in fact, most of them would not subscribe to such a position, although many ecologists make use of this definition. Scientists, quite explicitly, refer to the "second law of thermodynamics" (entropy law) to express their preoccupation in this respect (see Georgescu-Roegen 1971; 1973).

But there remains another sense in which (C2) is understood. In this version the destruction of nature is not taken in the sense of physics but in an evaluative sense. 'Destruction of nature' here refers to the disruption of the environment human beings live in. This version is usually implied in the following claim:

(C3): Ecological problems result from man's short-sighted exploitation of nature.

A "short-sighted" exploitation of nature can have two different meanings: (a) nature's intrinsic values are violated; (b) negative repercussions from exploited nature to man are not taken into account. As I shall explain below, only (b) can be used in a meaningful way.

The ecological discourse, however, does not usually speak of ecological problems, but of ecological crisis. The notion of crisis derives from medicine and has been applied to economy. It denotes the turning point of a pathological state (for example fever in medicine, depreciation of capital in economy). The notion of crisis thus introduces a dramatic dimension into the ecological discourse: it suggests that nature is undergoing an 'abnormal' development which has to culminate in a crisis which then gives way to a new, 'normal' state. But each crisis also can lead to the opposite result: in this case the 'infected' system (organism) will not recover but die.

From this last alternative we get the following prediction:

(C4) Current ecological crises lead necessarily to ecological catastrophes (and eventually to the final collapse.)

It goes without saying that much of the dramatic dimension of the ecological discourse rests on this element. To subscribe to this claim a clear analysis of the present situation and a reliable prognosis of the immediate future of the planet earth would be required. The following two examples may illustrate this. The first example is the problem of CO_2 emissions into the atmosphere. One position holds that this process will lead to the "greenhouse-effect", that the planet's atmosphere will be heated up in such a way that polar ice will melt and consequently many big maritime cities will be flooded. The counter-position holds that increasing emissions of dust will cause a counter-tendency which prevents the heating up and thus prevents the greenhouse-effect.

The second example is the question of scarcity of natural resources. Again, scientists have considerable disagreement; a judgement in this case depends on the answer to the question of

how fast technological progress will be (in order to find substitutes for scarce resources). Thus I think that many of the 'alarmist' statements are the expression of one tendency within a variety of competing claims.[12] For this reason I shall abandon the catastrophic prediction, but also the following claim:

(C5) Ecological problems are only temporal and not very severe; they will soon vanish.

which is the symmetrical counter-argument to (C4).

Passmore proposed the following, very broad definition: A problem is 'ecological' if it arises as a practical consequence of man's dealings with nature (cf. Passmore 1974:43). Since this definition avoids the problems of (C1) to (C5), and has the virtue of relating it clearly to human action, I shall adopt it as basis for the further discussion - with one additional qualification: "Practical consequences" means that man's dealings with nature retroact upon society in a way which is detrimental to human well-being.[13]

Man's dealings with nature are generally characterized by the following characteristics. First, man is part of nature, he is living in nature; biology defines him as the most highly developed

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12 In saying this I do not deny the existence of ecological catastrophes (in the sense of Perrows 'normal accidents', infra). What I deny is the logical status of these catastrophes in the above definition. There, it has the status of an instance for a "final crisis".

13 This definition takes into consideration the fact that also nature by itself can induce ecological problems. This is the case with floods, eruption of volcanos, fall of meteorites etc. The important point here is that we are obviously interested in ecological problems which are produced by society and the solution of which lie within the scope of social action.

mammal. Nature, however, is the realm of competition for survival. Thus human beings have to secure their position in nature as do other animals. But human beings distinguish themselves from other animals in their own particular way of maintaining life.

If we characterize human beings as living in, and dominating nature, this does not present two statements which are incompatible with each other. When we say that a problem is ecological when it arises as a consequence of man's dealings with nature, many might agree. But I think it useful to push the point a bit further. It does not mean that the very fact of dealing with nature (manipulation, domination, harnessing or seduction) is the crucial point, the "cause", so to speak, of ecological problems. Ecological problems arise only out of specific ways of dealing with nature. To repeat my claim from above: both man's existence in nature and his attempt to dominate nature are compatible, human beings live in and dominate nature.

Out of a misunderstanding of this relation, both ecologists and their declared enemies conclude the mutually-exclusive character of the two predicates. Both positions are wrong in that they identify the problem of dominating nature as the heart of the matter. Consider the following argument. (I take here the "anti-humanist" approach to extremes, thereby showing its absurdity.)

Recall (C4) from above. There we saw that a "pathological" state was distinguished from a "normal" state of nature. But it is difficult to know what is "normal" for nature. Ecologists will probably argue that the "normal" state of nature is a balanced state of nature. Since I cannot see how this definition can work without reference to human interests and definitions, I claim that nature is always in "balance with itself". Take the example of a river in which, caused by pollution (detergents), no fish survive. But instead of fish other animals and plants (e.g.algae) are

flourishing. The ecologist, confronted with such an argument, would probably say that if the river cannot return to the former ('normal') state with its own powers, its ecosystem would have to be called 'unbalanced'. But in so arguing, she would only reveal her preference for higher living organisms.[14]

Let us take the argument again a step further and consider the example of a river which is drying out. In this case again we have 'nature': sand, rocks, plants, insects, reptiles, mammals. The ecologist would now probably reply that nature's diversity and complexity has been destroyed. And here, ironically, we have the resurrection (if only implicit) of the anthropocentric view, viz. that it is man who has an interest in conserving natural complexity. Of course, I do see the possible argument that nature 'for itself' should be complex. But unless one adopts a mystical or religious standpoint, there is always a human interest behind the attitude that nature should be left out there "for itself". The reasons behind such an human interest are either of an aesthetic, or a purely selfish character or spring from man's general care about his environment. Mary Douglas' definition still provides a good insight into the problem. She claims that "uncleanness is matter out of place" (Douglas 1966:40). What makes a place wrong is dependent on the cultural value system of a given society. With respect to western societies we may say that it might be wrong aesthetically, that it is detrimental for health, or that it destroys wildlife, plants and animals (cf. Passmore 1974:45-6). If we do not conceive of the "selfish" character in a narrow, economic, short-termed way, all criteria can be reduced to

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14 Usually lower animals such as insects and bacteria are outside the concern of ecological reasoning. Albert Schweitzer tried to be consistent and defended the right of living for the tse tse fly and the tubercle. This position, radical in ethical and religious respect, makes impossible a consistent course of human action. Consider the case of the AIDS virus!

this category.[15] My suspicion is that the ecological discourse shaped its arguments in a counter-position to economics, and also took over a basic flaw of that theory: the identification of short term rationality (as expressed in economic behaviour) with rationality as such. Out of this identification it is only logical to refuse a humanist approach as a guiding line in solving ecological problems. Human beings are seen as inherently short-sighted; it follows that their needs must not count as criteria for ecological politics. Doing away with this confusion, the anthropocentric standpoint makes perfectly possible a concern about the 'flourishing of nature'; it is by no means bound to be an accomplice to the tendencies which cause ecological problems. Yet, what is more, I claim that this standpoint is the only one which can consistently speak in terms like 'flourishing nature' and the only one which lays its standard of critique open, thus facilitating analyses and solutions for these problems.

One cannot escape the cultural value system of contemporary western societies when criticizing it. This is to say that ecological fundamentalists are bound to participate in rational debates, to presuppose rationality standards, etc. As Krohn put it: "The critique of science must take the form of science, in order to be effective." (Krohn 1983:128, my translation).[16] The results of an

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15 Consider the case of a domestic animal which falls ill and which would die without medical care. Its "natural" destiny would be to die. But, if the owner of the animal so wants, he tries to get it cured. This attempt need not be ethical because he may try to cure it on purely selfish grounds i.e. simply because he would feel bad if the animal died without his effort to prevent it from dying.

16 Similarly, Maren-Griesebach wrote: "Ökologie als Grundlage für das Handeln, für die Politik. Und da es eine wissenschaftliche Grundlage ist, exakt beweisbar, nachprüfbar, also genau den Ansprüchen der abendländischen, rationalen Wissenschaftlichkeit genügend, dürfte sich niemand drumherum drücken." (1981:32, cited in Oechsle 1988:146)

'ecologically inspired' research (for example, the emerging discipline of ecosystems research) may thus, again ironically, contribute to a better domination of nature. As van den Daele (1987) has shown, "bedeutet also die Ökologie nicht den Übergang zu einem nichttechnologischen, vielleicht kontemplativen Konzept der Natur, sondern zu einem besseren technologischen Konzept. Die Baconische Vision der Herrschaft über die Natur wird nicht etwa verlassen, sondern perfektioniert." (van den Daele 1987:414).

Since the mechanism of man's dealings with nature does not provide any barrier for a more perfect domination of nature, this barrier - if one wants to have one - must be established by man. The ecologists do establish such a barrier in re-moralizing nature and science, thus challenging the famous claim of Bacon who once formulated that it is an error to believe that "the inquisition of nature is in any part interdicted or forbidden." (1986:20)[17] In his view nature is "a granary and storehouse of matters, not meant to be pleasant to stay or live in, but only to be entered as occasion requires, when anything is wanted for the work of the Interpreter..." (1986:255, orig. emph.)[18]

1.3. Causes of ecological problems

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17 Cf. also Kant in the Preface to Kritik der reinen Vernunft: "Die Vernunft muß mit ihren Prinzipien, nach denen allein übereinkommende Erscheinungen für Gesetze gelten können, in der einen Hand, und mit dem Experiment, das sie nach jenen ausdachte, in der anderen, an die Natur gehen, zwar um von ihr belehrt zu werden, aber nicht in der Qualität eines Schülers, der sich alles sagen läßt, was der Lehrer will, sondern eines bestallten Richters, der die Zeugen nötigt, auf die Fragen zu antworten, die er ihnen vorlegt."

18 Marx shared this position, as we shall see in chapter 2.

In 1.2. I have sketched some essential human features in their relation to nature. From this we can conclude the abstract possibility of ecological problems, for it is always possible that man acts in a way upon nature which causes changes in nature detrimental to his own life.

In what follows I present several approaches which have been applied to investigate ecological problems or which can be used for this purpose. We may divide them into economic and sociological ways of looking at the problem,. The latter will be presented in 1.3.2. and 1.3.3., the former in 1.3.4. - 1.3.7. Generally we may distinguish between two completely different mechanisms which are at work, which 'cause' ecological problems, so to speak. The first conceives ecological problems as a result of purely intentional behaviour, whereas the second conceives them as essentially by-products of human action, as unintended in character. The first mechanism can be expressed in the economists' approach of "externalities" which are the result of the strategy of an entrepreneur to externalize his costs as far as possible. The second mechanism has been studied above all by philosophers and has been taken up by social scientists.[19]

In determining what counts as 'intended' and 'unintended' the time horizon which is presupposed is crucial. Not by chance do the economists disregard long-term consequences of economic behaviour; they are transformed into 'social costs'. Likewise, although the producers and consumers of certain potentially damaging products may be aware of the inherent danger, they nevertheless decide to produce and use (consume) them. But they at the same time make their calculations about future developments. Some think that the

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19 To be sure, the two are ideal types which may not exist in this pure form. A firm which externalises may not be aware of causing a specific type of ecological damage.

consequences of their behaviour will not react upon them, or will occur only in a distant future; others think that they will not be alive to witness the catastrophic results (après moi le déluge); still others think that no catastrophes in the future will take place because of the beneficial technical innovations which reduce or abolish the dangerous potential of these products, or, likewise reduce or abolish already manifest pathological symptoms.

The unintended character of human action stresses the limits to human design. It is thus more pessimistic regarding the possibilities for abolishing ecological problems. Even if it were the case that entrepreneurs were not externalizing costs, but ecologically aware, even if it were the case that no dangerous products are produced deliberately, there may be damages to the environment (if only in the long run). The two mechanisms are intertwined if we consider long time-spans and take human experience into account. Here the actors know that their actions may have detrimental effects on the environment, but they 'take the risk', the more so the more the consequences of that action will show up only in a distant future. Ecological problems are thus no 'information problems' in the first place. Even if people are well informed about the inherent dangers of some products/actions etc. they are not likely to stop it. This mixed form of unintended/intended mechanism is thus present in 1.3.3. - 1.3.7. I start out with a discussion of technology which seems to be the decisive precondition for modern ecological problems which should not to be confused with a cause of them.

1.3.1. Technology

Above, I said that ecological problems arise from man's dealings with nature. In modern societies these dealings take place on an industrial level, and are carried out by technological means. We

may generally distinguish two possible types of ecological problem:

a) ecological problems arising out of the "normal" working of technology;

b) ecological problems arising out of accidents or catastrophes.

Instances of a) are, among many others, acid rain or toxic substances in food chains. Instances of b) are accidents like Three Mile Island, Tschernobyl, Seveso or Bhopal. While I turn my attention to a) throughout the remainder of this section, I shall consider b) in 1.3.3.

The report of the United Nations commission attributes to technology a prominent place: "Emerging technologies offer the promise of higher productivity, increased efficiency, and decreased pollution, but many bring risks of new toxic chemicals and wastes and of major accidents of a type and scale beyond present coping mechanisms." (United Nations 1986:16). Commoner expressed a similar view: "In modern industrial societies, the most important link between society and the ecosystem on which it depends is technology. There is considerable evidence that many of the new technologies which now dominate production in an advanced country such as the United States are in conflict with the ecosystem. They therefore degrade the environment." (Commoner 1971:178-9)

A simple consideration makes clear that technology stands at the heart of the matter. Mankind in its early stages, with primitive technology, could not affect its environment in the same way as mankind can today: the axe and fire could not, even under conditions of most careless use, cause dangers which were in the

least comparable to present dangers which arise out of the use of nuclear or chemical technology. [20]

The difference, then, lies, as I said, mainly in the greater scope and greater complexity of modern technology in comparison to old technology. Greater scope means that a single malfunctioning of modern technology may affect regions and people far away from the event; it may affect a larger number of people and for a longer time span. Greater complexity means that modern technology is a composition of many parts which are embedded to a big degree in an institutional framework; social institutions and technology permeate each other. Both are complex in their nature, thus increasing complexity. This leads to an ever-decreasing degree of transparency (see 5.5.).

This makes it very difficult to determine more precisely 'causes' for ecological problems. It follows that the solution of ecological problems is equally difficult to achieve. If a chemical factory puts hazardous waste on a field, we can identify the cause and its solution immediately. As Luhmann pointed out, in such cases an adapted police-law would suffice (Luhmann 1986:26). But in most cases things are not so easy. As Passmore has put it, "the solution of an ecological problem will normally depend on the ... solution of a sub-set of problems - scientific, technological, economic, moral, political, administrative - each with its own style of solution." (Passmore 1974:46)

Thus interdisciplinary research is required to render possible a scientific understanding of ecological problems. There has been a considerable boom of ecological literature in the last few years

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20 In some cases the burning of woods has led to the unintended consequence of improved soil.

which does consider itself 'interdisciplinary'. Even the term 'super-science' has been coined for ecology, but a big part of it must be characterized as dilettante[21]. This is because the subject matter is so complex that no existing single discipline of science (let alone a single person) can make competent analyses.[22] The emerging 'eco-systems research' and the institutionalizing of 'technological assessment' (see McBrierty 1988; Smits/ Leyten 1988; Tuiniga 1988) are steps in the direction of a truer interdisciplinary dimension.

1.3.2. Unintended consequences

Suppose now that scientific research has yielded results and we are able to understand the working of a particular ecological problem. What comes next is (at least in many cases) the development of a new technology, a technology which reduces or eradicates the undesired outcome of the old technology. [23] Paradoxically, here we may enter a vicious circle, because the production or operation of the new technology may also produce ecological problems. As Passmore said: "Any technological innovation... involves an element of ecological risk; it is impossible to calculate all its consequences in every possible circumstance."

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21 As Enzensberger observed, "Ökologe ist im Grenzfall jedermann." (1973:2)

22 Of course, many biologists have tried to develop solutions for the social, political, economic or legal sphere, but they did not seem to be very appealing to their adressees.

23 I do not consider here such simple cases as the 'adapted police law' or any other 'simple new law' which is able to abolish any existing ecological problem in one blow.

(Passmore 1974:49)[24]

Modern technology thus exhibits a feature of social life in general: human actions and intentions are crossed, mixed and annihilated by unintended consequences.

Merton addressed the problem of unintended consequences in the following way.[25] First he limits a correct anticipation of consequences of action to an existing state of knowledge. Especially in situations which demand immediate action of some sort, the probability is high that we do not act on the basis of scientific knowledge but on opinion and estimate. As Merton himself put it:

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24 Cf. also Perrow: "It is particularly important to evaluate technological fixes in the systems that we cannot or will not do without. Fixes, including safety devices, sometimes create new accidents, and quite often merely allow those in charge to run the system faster, or in worse weather, or with bigger explosives. Some technical fixes are excuses for poor organisation or an attempt to compensate for poor system design." (Perrow 1984:11)

25 He calls them unanticipated consequences and makes clear that "undesired effects are not always undesirable effects." (Merton 1937:895) From this it follows that undesired unanticipated consequences can be equated with unintended consequences (in the sense I use the term). Note that Merton in his later "Manifest and Latent Functions" defines three types of unintended consequences (cf. Merton 1968:105): functional, dysfunctional and irrelevant consequences. Ecological problems resulting from unintended consequences are thus clearly dysfunctional in character; but, as we must ask, dysfunctional in regard to what? According to my discussion in 1.2. there can be no dysfunctional consequences for the (natural) environment. But if we look at specific social systems, dysfunctional consequences may appear for parts of the economic system (for example: rise in prices for raw materials), the health system (increase in diseases), in the political system (for example: overburdening with legitimation). Additionally, the latter cannot regulate the problems by law in a simple way, but may instead trigger off a vicious circle by its very intervention. I shall come back to this point in chapter 2.

> Moreover, even when immediate action is not exacted, there is the economic problem of distributing our fundamental resources, time and energy. Time and energy are scarce means and economic behavior is concerned with the rational allocation of these means among alternative wants, only one of which is the anticipation of consequences of action. In our present economic order, it is manifestly uneconomic behavior to concern ourselves with attempts to obtain knowledge for predicting the outcomes of action to such an extent that we have practically no time or energy for other pursuits. (Merton 1937:900)

The second factor is error. This means that actors often assume that "actions which have in the past led to the desired outcome will continue to do so." (Merton 1937:901) The third factor is what has been called "imperious immediacy of interest" and refers to instances "where the actor's paramount concern with the foreseen immediate consequences excludes the consideration of further or other consequences of the same act." (id.) Merton further explains that the action may be rational "in the sense that it is an action which may be expected to lead to the attainment of the specific goal; irrational, in the sense that it may defeat the pursuit or attainment of other values which are not, at the moment, paramount but which nonetheless form an integral part of the individual's scale of values." (ibidem: 902) This, however, is not only a question of conflicting values, but of short term and long term rationalities. Ecological problems seen in this way would suggest an identification of the paramount interest with the immediate economic benefits; other values (for example, environment) are suppressed and become a long-term concern. A similar, but distinct factor concerns the basic values involved in the course of human action: "activities oriented toward certain values release processes which so react as to change the very scale of values which precipiated them." (ibidem:903) Instances of this are self-defeating processes like

the rise of protestant ethic which in the end brought about wealth and abundance. Viewing ecological and economic values in this perspective, one may say that the results of the dominating economic value in western societies has contributed to the emergence of its 'antagonist': the (fundamentalist) defenders of ecological values who express their paramount concern with immediate ecological goals, no matter what the result for the economy. The fourth and last factor Merton mentions is the intriguing fact that successful social prediction and planning is often hampered by public predictions of future social developments "precisely because the prediction has become a new element in the concrete situation, thus tending to change the initial course of developments." (ibidem:903-4) Applying this last model again to ecological problems, we may for once receive a more optimistic picture: we might expect that the apocalyptic tone of the first world reports on environment have already changed the course of development, leading to a decline in pollution and a slower depletion of resources. But if we consider Merton's third factor, where a basic value becomes self-defeating, then we may get a much more pessimistic picture: then, the reduction in ecological damage results in the decline of ecological awareness thus allowing a new (vicious) cycle.

As we have seen, the feature of unintended consequences makes social planning difficult.[26] This is basically due to the fact that we cannot predict the character of these consequences: they may be inherently beneficial or harmful (to all of mankind or to parts of it; in respect of short term or long term considerations). Broadly speaking, we can summarize Merton's typology into two classes: unintended consequences as resulting from imperfect

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26 As Passmore said: "this is not a very encouraging line of reasoning... [b]ut it is at least realistic, firmly based on human history, ...that the unintended consequences of men's action are more important, for the most part, than the consequences they intend." (Passmore 1974:83-4)

knowledge ("error" being part of it) or as resulting from the actor's paramount concern with immediate results. In 1.3.3. the knowledge aspect plays a crucial role but is also mixed with the second aspect whereas in 1.3.6. and 1.3.8. the "imperious immediacy of interest" will be centrally important.

1.3.3. Industrial accidents

I now come to the second possibility (supra): industrial accidents. Up to now we have arrived at the possibility that some industries, during their 'normal' working, pollute i.e. produce toxic or otherwise dangerous waste. Now I shall consider the possibility that some industries (irrespective of whether working "cleanly" or not) are likely to produce accidents which set free toxic or otherwise dangerous substances.

Charles Perrow has studied high-risk technologies and their institutional setting, combining the study of organizations with the study of technology. His analysis thus contains two elements: technology (see 1.3.1.) and unintended consequences (see 1.3.2.) As Perrow pointed out, some characteristics of high-risk technologies "suggest that no matter how effective conventional safety devices are, there is a form of accident that is inevitable." (Perrow 1984:3)

This alarming conclusion is derived from the specific features of modern technology: "[M]ost high-risk systems have some special characteristics, beyond their toxic or explosive or genetic dangers, that make accidents in them inevitable, even 'normal'. This has to do with the way failures can interact and the way the system is tied together." (Perrow 1984:4) This sort of system is

characterized by 'interactive complexity' and 'tight coupling'.[27] If both taken together will inevitably produce an accident, this would be the case for a normal or systems accident in Perrow's definition. As he makes clear, "we have such accidents because we have built an industrial society that has some parts, like industrial plants or military adventures, that have highly interactive and tightly coupled units. Unfortunately, some of these have high potential for catastrophic accidents." (Perrow 1984:8)

A well-known and widespread view blames the operators for causing accidents. Perrow, however, shows that "the operator is confronted by unexpected and usually mysterious interactions among failures." Saying "that he or she should have zigged instead of zagged is possible only after the fact. Before the accident no one could know what was going on and what should have been done." (Perrow 1984:9)

It is complexity and tight coupling which has to be seen as cause for a 'normal accident'. These two features make it possible that small and trivial beginnings often cause great events. "Where chemical reactions, high temperature and pressure, or air, vapor, or water turbulence is involved, we cannot see what is going on or even, at times, understand the principles. In many transformation systems we know what works, but sometimes do not know why. These

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27 Perrow employs two variables in his analysis: linear/complex systems and loose/tight coupling. Linear processes and loose coupling are less prone to system accidents. But note that even "the most linear of all systems will have at least one source of complex interactions, the environment, since it impinges upon many parts or units in the system." (Perrow 1984:75) "Loosely coupled systems, whether for good or ill, can incorporate shocks and failures and pressures for change without destabilisation. Tightly coupled systems will respond more quickly to these perturbations, but the response may be disastrous. Both types of systems have their virtues and their vices." (1984:92)

systems are particularly vulnerable to small failures that 'propagate' unexpectedly, because of complexity and tight coupling." (Perrow 1984:10)

Perrow's approach must not be confused with the so-called "Murphy's Law" (i.e. that everything that can go wrong will go wrong). As Perrow himself put it: "The legendary Murphy was wrong. His law, that if anything can go wrong it will, is disproved by almost all post-accident investigations of large disasters. These investigations repeatedly point out that 'it was lucky it wasn't worse.'" (Perrow 1984:111)

Not all systems, however, display the characteristics outlined above. Systems which are not very complex and are not coupled tightly, can still have accidents, as all systems can. "But they are more likely to stem from major failures whose dynamics are obvious, rather than the trivial ones that are hidden from understanding."(1984:10)[28]

In conclusion, we might say, then, that there exists something which is likely to produce catastrophic accidents: the high-risk-systems. Perrow investigated the following technologies: nuclear

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28 It is worth noting that on the basis of Perrow's analysis the process of specialization alone does not lead to a loss of control over technology or to detrimental effects of technology on the natural environment or on human well-being. But this is exactly Tiezzi's claim: "Le technologie, si afferma, devono avere un grosso contenuto scientifico, perché oggi uno dei parametri fondamentali nel sistema produttivo è la complessità. Ma questo comporta aumento di specializzazione e, di conseguenza, perdita di controllo e di conoscenza della realtà (che è complessa) sia da parte della gente che da parte degli specialisti stessi. Più ci si specializza,meno siamo in grado di prevedere gli effetti della tecnologia sulla natura." (Tiezzi 1984:35) This is a rather exaggerated view since the problem is not whether technologies can (or should) be controlled by everybody. In this respect every specialization erects a barrier to such "egalitarian" claims. The problem is rather that complex technologies may not even be controllable by specialists.

energy, petrochemical plants, shipping, air traffic, genetic engineering, space missions, dams, mining and weapon systems. The result is that the most catastrophic potential resides in nuclear weapons and nuclear power; hence they should be abandoned. Marine transport and DNA recombination have only little less catastrophic potential, hence they should be restricted. The last category are chemical, mining, airways, space and dams which, according to Perrow, should be tolerated and improved. (cf. Perrow 1984, chapter 9)[29]

Summarizing 1.3.1. to 1.3.3. we may state that modern industry's potential for causing ecological problems is considerable. To forestall another point of this chapter it must be said that few of the outlined characteristics of high-risk systems can be deduced from the institution of private property.

1.3.4. Economic growth

A further candidate for causing ecological problems is industrial growth. The explanation is straightforward. Low levels of industrial production produce low levels of output hence low degrees of waste and possible pollutants. High levels of industrial production produce high levels of output hence high levels of waste and possible pollutants.[30] Regarding the input side, we can establish a similar link: low levels of industrial growth require low amounts of natural resources, high levels of production require high amounts of resources (regarding both energy supply

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29 "On the whole, we have complex systems because we don't know how to produce the output through linear systems. If these complex systems also have catastrophic potential then we had better consider alternative ways of getting the product, or abandoning the product entirely." (Perrow 1984:89)

30 Some fundamentalist ecologists, such as the German Carl Amery, thus demanded production to stop where possible (cf. Amery 1978:167)

and raw materials). It is commonly agreed that the period since the Second World War has been a period of exceptionally rapid economic growth which caused a considerable amount of hitherto unknown ecological problems. But even given declining or low levels of industrial production, ecological problems are likely to survive, given the characteristics of modern technology. As Barry Commoner put it: "'Economic growth' is a popular whipping boy in certain ecological circles. As indicated earlier, there are good theoretical grounds why economic growth can lead to pollution... However, this theoretical relationship does not mean that any increase in economic activity automatically means more pollution. What happens to the environment depends on how the growth is achieved." (1971: 141)

Commoner emphasizes the impact of new technologies which have been used in the US economy since the Second World War, insisting on the point that "the post-war technological transformation of the United States economy has produced not only the much-heralded 126 per cent rise in GNP, but also, at a rate about ten times faster than the growth of GNP, the rising levels of environmental pollution." (ibidem, 146)

Beckerman, in a straightforward way, defended economic growth in the following terms: "For even if there were no growth, and even if national product were declining, there would still be a danger, in the absence of appropriate policies, that pollution would be excessive and that insufficient resources would be devoted to the preservation of the environment." (Beckerman 1974:105) This is so because pollution reflects a failure of the market rather than being a result of economic growth (cf. id.). Thus, if people "think that growth must be stopped or slowed down on account of excessive pollution" (Beckerman 1974:18), they are completely mistaken. Pollution has nothing to do with growth but is a question of misallocation of resources (cf. id.;35;104).

In the following discussion I concentrate on approaches which all in one way or another have to do with economic rationality, market behaviour, or "western" rationality as such. I start with the sort of economic behaviour which is characterized by burdening costs to the public ("externalities") and consider then a game-theoretic formalization. The difficult question then arises as to whether this economic behaviour is typical for market economies (such as capitalism) or if it is a more general pattern which would also apply to post-capitalist societies. Since we find empirical evidence for the latter assumption, we must try to explain it.

1.3.5. Market, Externalities, and the Tragedy of the Commons

Pigou, over fifty years ago drew attention to the following feature of economic behaviour: "[S]moke in large towns inflicts a heavy uncharged loss on the community, in injury to buildings and vegetables, expenses for washing clothes and cleaning rooms, expenses for the provision of extra artificial light, and in many other ways." (Pigou 1932:184).

This leads to the tendency of private capital to externalize costs. As Passmore points out, the owner of a factory calculates "that he will only have to meet such costs as directly arise from his particular enterprise, such costs as raw materials, labour, machinery, depreciation, taxation, insurance. He does not expect to meet the cost of replacing Mrs Jones' curtains, even if it is the smoke from his factory that causes them to rot." (1974:65).

Neoclassical economics would argue that the market principle leads to beneficial outcomes in this respect provided that a system of property rights is established which includes natural

resources like air or water.[31] Saleable rights would provide the mechanism for this system. Against this, some authors have argued that the introduction of market principles into economy was a decisive factor for the depletion of resources. Before the advent of the market, traditional mechanisms occupied its place. Often these were based on tribal or kinship-relations and were nature-conserving (Victor 1980:205). As Victor, drawing on Polanyi (1944), maintains, the market principle in fact introduced a damaging tendency. Under market conditions the earth is no longer property of the people who live on it, but an exchangeable good. Under market conditions a company (or any other) may buy a piece of land and extract resources in order to use them up by producing a specific good or simply to sell them. When the job is done, the company moves away and leaves the place. It leaves it to anonymous future inhabitants. The difference between a society in which the inhabitants of a certain area are the common owners of the earth, taking the best care of it, and a society in which land has become a commodity, then, is that the former seems to be more apt to avoid ecological problems than the latter. It is assumed that people who own a certain thing commonly (land in our case) will take best care of it. This could also be interpreted as an example of a successful assurance game (1.3.6.). But here neoclassical economists would argue that it is quite the contrary. They have it that the trouble begins with common property:[32]

> Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day

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31 Beckerman (1974) concedes that the market principle fails to prevent pollution since nobody has property-rights in natural resources like air or water.

32 Actually, Hardin is a biologist but the logic of his argument is comparable to what neoclassical economists would hold.

> of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselesly generates tragedy." (Hardin 1980:104)

This is so because as a rational being the herdsman seeks to maximize his gain. Since he is to get the full amount of increment if he adds one animal to his herd and he is only to share a part of negative effects of overgrazing he concludes that the best thing he can do is add another animal to his herd. Hardin comments: "But this is the conclusion reached by each and every rational herdsman sharing commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in the commons brings ruin to all." (Hardin 1980:104)

Note that in one case the market is praised to prevent ecological problems whereas in the other it is accused of causing ecological problems. How can one explain these opposing judgements of collective ownership? An answer to this would certainly focus on the important role which <u>cultural values</u> play in cases where common property exists. If there are cultural patterns which prevent the common owners form overfishing, overgrazing etc. there need not arise a <u>tragedy</u> of the commons. Only in cases where such patterns do not (or no longer) exist can the neoclassical argument come in. This has been rightly identified as a strategic point for bringing in a sort of "environmentalist ethics" here. Thus Hardin writes:

> [T]he logic of the commons has been understood for a long time, perhaps since the discovery of agriculture or the invention of private property in real estate (Hardin 1980:105) ... but the inexorable succession of generations

> requires that the basis for this knowledge be constantly refreshed." (Hardin 1980:104)

The logic of the commons is understood mostly only "in special cases which are not sufficiently generalized... the oceans of the world continue to suffer from the philosophy of the commons. Maritime nations still respond automatically to the shibboleth of the 'freedom of seas'. Professing to believe in the 'inexhaustible resources of the oceans', they bring species after species of fish and whales closer to extinction." (Hardin 1980:105)

And Victor claims: "These examples from history indicate that the expansion of the market system created the tragedy of the commons by weakening the traditional forms of social relations which had hitherto prevailed. It is the reconstruction of social structures such as these, combined with the propagation of an environmental ethic, that environmentalists argue is an essential ingredient in an effective environmental policy." (Victor 1980:206)

Consider now the case of socialist society. As has been argued, countries with state ownership of the means of production are less likely to produce ecological problems for two reasons. First, so the argument goes, socialist enterprises do not introduce prematurely certain (dangerous) technologies which are introduced prematurely in capitalism in order to gain extra profits. Second, because of central planning (and the absence of the profit principle) individual socialist enterprises can not externalize their costs to the environment.

While it may be true that dangerous technologies are introduced in capitalism prematurely (in order to make short-term profits), it is not necessarily true that socialism does better in this

respect. In fact, the actual record of socialist countries eludicates and confirms this point.[33] What can account for this?

My answer here cannot be exhaustive but I think the following factors explain a lot. In addition to what has been said above with respect to common property, I would add the following. It is not true that only private enterprises (profit maximizers) cause ecological problems. The same holds true for state enterprises and private consumers in capitalism, and for enterprises and consumers in socialist countries. One reason, therefore, has been explained by Max Weber: it is the expansion of the "rationality-principle" in the modern epoch. In capitalist enterprises economic calculation is carried out mainly by means of money, which is, according to Weber, the most rational way of orienting economic activities (cf. Weber 1978:86). As Weber also makes clear, a planned economy which is based on the principle of need satisfaction and on calculations in kind, "would have to determine 'value'-indicators of some kind for the individual capital goods which could take over the role of the 'prices' used in book calculation in modern business accounting." (Weber 1978:103) No matter how this difficulty is resolved, whether by indicators in weight (in fact, some socialist countries use tons as an indicator) or in value, socialist countries also try to enhance economic efficiency.

But are socialist countries not in a better position in so far, as they can anticipate ecological costs, if not ecological problems? My answer is that state planning is not sufficient to avoid ecological problems. Five reasons oppose such a hope:

a) As already pointed out above, (at least) high-risk systems produce ecological problems. Hence no matter what basic property

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33 See some recent reports in Rosenbladt (1986).

relations in a certain society obtain (private ownership or state ownership), 'normal' or 'systems' accidents are likely to occur. Because of their scope and dangerous potential, these complex technologies can create ecological problems for a great number of people over a long period of time.

b) A second factor which makes central planning problematic as a solution to ecological problems is the feature of unintended consequences (see 1.3.2.) which, if true, is a general threat to "planning the future";

c) Collective ownership (for example of means of production) may lead to "the tragedy of the commons". Also in this case we have the spectre of externalities (social costs) which we already defined as one of the causes of ecological problems. Given certain conditions, (see 1.3.6.), the logic of public goods can be applied here;

d) As has been pointed out, the price system in countries like the Soviet Union does not allow for taking into account the scarcity of resources. This is so because the dominating ideology forbids establishing prices which are not the result of labour time (dogma of the labour theory of value) (cf. Kupilik 1982:169-70). Moreover, the specific mechanisms of "success indicators" lead to a reward system which "does not provide incentives for concern for the environment" (Kupilik 1982:171);

e) Although the Soviet Union is a country with one of the most ambitious environmental legislations, existing law is not enforced (see Goldman 1972, as cited in Kupilik 1982). Firms which are found guilty of polluting are punished only with (relatively) small fines. This leads in effect to the result that firms already take into account the cost of the fines into their budget (Kupilik 1982:171).

Whereas a, b, and c apply to socialist societies in general, d and e are historically specific traits of soviet society. We may imagine a non-soviet type of socialism which is not committed to the labour theory of value and which enforces its environmental laws; but even in this case we would have a) to c) as candidates for ecological problems. The outcome of this discussion, then, is contrary to the intuitions of many, that private property is a less probable factor in causing ecological problems and that a socialist society is in no structurally better position to avoid ecological problems. This is so because there are no mechanisms built into socialism which would avoid these problems. Of course there are ecological problems in capitalist societies which are connected only to short-term profit considerations but these do not explain the broader phenomena or their existence in socialist countries.

1.3.6. Prisoners' Dilemma

No matter whether the market combines the private producers and consumers in a society or whether forms of common property exist, we may try to apply the logic of the 'Isolation game' or 'Prisoners' Dilemma' (PD) to ecological problems. This model has been developed by game theory (cf. Luce and Raiffa 1957) and introduced into the Social sciences by Olson's (1965) influential book. Sen presented it in the following way:

> "Two prisoners are known to be guilty of a very serious crime, but there is not enough evidence to convict them. There is, however, sufficient evidence to convict them of a minor crime. The District Attorney - it is an American Story - separates the two and tells each that they will be given the option to confess if they wish to. If both of them confess, they will be convicted of the major crime on each other's evidence, but in view of the good behaviour shown in squealing, the District Attorney will ask for a penalty of 10 years each rather than the full penalty of 20

> years. If neither confesses, each will be convicted only of the minor crime and get 2 years. If one confesses and the other does not, then the one who does confess will go free and the other will go to prison for 20 years." (Sen 1982:62)

The probable outcome is that "each prisoner feels that no matter what the other does it is always better for him to confess. So both of them do confess guided by rational self-interest, and each goes to prison for ten years." (id.:63)

We can take this "game" as 2-person game and apply its logic to a n-person-game. In a n-person-game the following modification occurs, as LiFeldman observed: "Unlike the Prisoners' Dilemma, where all parties must cooperate to achieve the solution, a free rider case [which is represented in the n-person-game, R.G.] allows for some defectors." (LiFeldman 1986:25. Important is "some" here, for if a considerable number of players defects, we would be in the logic of a 2-person-game again, where we have the options of cooperation and a non-cooperation.) Rawls also referred to a free-rider case when he wrote:

> "Where the public is large and includes many individuals, there is a temptation for each person to try avoid doing his share. This is because whatever one man does, his action will not significantly affect the amount produced. He regards the collective action of others as already given one way or the other. If the public good is produced, his enjoyment of it is not decreased by his not making a contribution. If it is not produced his action would not have changed the situation anyway." (Rawls 1972:267)

In order to apply the logic of public goods to ecological problems, two conditions must be fulfilled. The first is that ecological problems be manifest, the second that their removal create a 'public good'. The first condition is not always met because many

ecological problems are invisible and accumulate unknown; for a long time they do not show up as a problem. Only if an ecological problem is obvious (if, for example, polluting is taking place before everyone's eyes) and its stopping would generate a public good, collective action could lead to the production of that public good. Consider the case of some towns which pollute a river or a sea. Here we have a n-person game which can be represented as follows. Since each actor has to decide his actions vis-a-vis all other actors, we may speak of "me" as the actor in isolation from the "others".

Figure 1

		All others	
		Do not cooperate	cooperate
Me	Do not cooperate	dirty water (no cost to me)	clean water (no cost to me) 1
	cooperate	dirty water (cost to me) 4	clean water (cost to me) 3

The expected outcome, then, is suboptimal since my preference always will be not to cooperate, since whatever the others do, that will put me in the best position; not cooperating gives me a free ride if all others produce the public good and I am not worse off in case they do not; then I have not paid any costs (but the water stays dirty). Note that even a contractual solution needs enforcement, for "even if a contract is arrived at, it will be in the interest of each to break it." (Sen 1984:136).

However, there may be an optimal outcome, if we consider somewhat different preference patterns. As Sen put it, "In the special

case when everyone else [cooperates], the individual now prefers [to cooperate] himself." (Sen 1984:137). In this 'Assurance game' the PD is most amenable to resolution. "In the assurance game, an individual's dominant strategy is no longer non-cooperation. If we assume perfect information for the players, then they will all choose [cooperating] in the safe expectation that others will too, since it will be in everyone's interest to do so." (Shaw 1984:26) "Theorists generally concede that the isolation paradox is most amenable to resolution in relatively small groups..." (Shaw 1984:31)[34] "Enlightened egoists can be brought into collusion because of their knowledge that the situation will be repeated and that reprisals are possible..." (Shaw 1984:27) In this case the preference ranking in the above table would be modified: 2 and 3 are changing places. Apart from enforcing rules there exists the possibility that "selective incentives" induce actors to cooperate.

1.4. Summary

Summarizing the causes for ecological problems, I should make clear that there can be no monocausal explanation. All of the factors may be causing an ecological problem under certain conditions. These "certain conditions" are partly contained in the other factors such as that the combination of two or more factors is sufficient to cause an ecological problem.[35] Take technology, for example. It is damaging only if (in the case of pollution) "ecological costs" can be externalized and no agreement with other concerned parties is reached. It is damaging (in the case of resources) only if market prices make it profitable to exploit these resources and if no laws restrict the exploitation; the

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34 Cf. Luce and Raiffa (1957:97).

35 The only exceptions are high-risk-systems which represent a sufficient factor on their own.

"tragedy of commons" is only damaging if cultural values do not prevent the damage, etc.

To conclude, the salient points of this chapter are the following. (1) I have distinguished the anthropocentric from the ecocentric approach showing the former's superiority; (2) In so doing, it is possible to derive the criteria for evaluation (they are dependent on man's interests, needs, pleasures and desires); (3) I have defined what counts as an 'ecological problem' and that it results (as an abstract possibility) from man's dealings with nature; (4) I have then looked at the causes for the actual emergence of ecological problems, using approaches from game theory, social and economic theory. The result is that technological and institutional complexity constitute a severe barrier for conscious human design, hence for a world without ecological problems; (5) Private property cannot count as a prime cause of ecological problems neither can any other single factor (except high-risk systems); (6) The market and systems of common property may be equally beneficial or detrimental to the environment, depending on the concrete historical and cultural conditions.

CHAPTER 2: ECOLOGY, THE SOCIAL SCIENCES, AND MARXISM

> Prometheus, der den Menschen den Blitz ausgeliefert, aber sie nicht gelehrt hatte, ihn gegen die Götter zu gebrauchen, wurde wegen seiner Tat, beziehungsweise wegen seiner Unterlassung, im Auftrag der Götter, von Hephaistos dem Schmied an den Kaukasus befestigt.
>
> Heiner Müller

The ecological debate only recently became a topic for social theory. There have been many works which were directed, instead, against some dominant paradigms in economic and social theory, like those of Mishan (1967), Meadows (1972), Schumacher (1974), Gorz (1977, 1980, 1983). There have been "ecological" analyses from economists like Georgescu- Roegen (1971), Daly (1973); works from moral philosophers like Feinberg (1974), Passmore (1974); works from technic-philosophers like Mumford (1977), Rapp (1978) - but no outstanding contribution from sociology "as such". There are exceptions represented in works on a meta-theoretical level, inspired by the sociology of knowledge, like van den Daele (1987) or Oechsle (1988). There are also works from organizational sociology, most notably Perrow (1984). The works of Bühl (1981), and Luhmann (1986) also have an organizations and systems theoretical background.

This situation was reflected in chapter 1 where, apart from considering Merton's and Perrow's analyses, I focused mainly on approaches which developed within economic theory. Now it has often been noted that the economists' and the environmentalists' views are inevitably at odds with each other. The first attribute no intrinsic value to nature as such and think in short-term economic outcomes, as effected by actors' preferences. The latter, by contrast, pursue a "deontological" argument and think that

nature has an intrinsic value which should be respected and preserved. Hence their concern about nature is profound and the time horizon is rather wide, stretching also to future generations. The actors' preferences of the economists are criticised as a distorted version of "real human needs". In this chapter, I try to propound a position which avoids the pitfalls of both approaches. Odd though it may seem, I take sides with the economists in denying that any intrinsic value in nature exists. This instrumentalist view of nature, however, does not squeeze out ecological concerns - on the contrary, it does so only if the economists' interpretation of "value" is accepted. However, in my view, the economists' approach to ecological problems is far too narrow. In continuation of my argument in chapter 1, I propose to enlarge the instrumentalist view of nature (in adding scientific, aesthetic, and ethical elements to it) and subsequently to arrive at a position from which it is possible to evaluate ecological problems and possible solutions from a human standpoint, taking human needs and interests (2.5.) as a starting point, rather than narrow, short-sighted economic preferences. In so doing, I take sides with the ecologists' concern about our natural environment. It seems commonly accepted that the economists' denial of any intrinsic value in nature and the environmentalists' affirmation of precisely this value are the only possible (extreme) ways to conceive of the problem. From this, it is concluded that we face a dilemma which we cannot avoid. The only thing we could and must do, is to make a choice between these opposing claims: either we choose "nature", and "life" or we choose "wealth", and "efficiency". When I claim that we have a third possibility, I try to espouse the the environmetalists' concern about the natural environment without committing myself to the metaphysical notion that nature has an intrinsic value for itself. In this chapter, I want to show how Marx's theory concords with such an approach, thus proving its value for investigating ecological problems.

Especially important is Marx's distinction between "wealth" and "value".

The present chapter proceeds as follows. I first try to relate the findings of chapter 1 to Marx's theory in a direct way (2.1.) and then reconstruct some of Marx's arguments from within his body of thought as laid out in 2.3. In 2.4. I will discuss the concept of nature in Marx, and in 2.5. Marx's philosophical anthropology.

2.1. How can we relate Marx to ecological problems?

Recall the discussion of 1.2. where I discussed several claims with respect to ecological problems. How is it possible to relate elements of Marx's theory to them? I think that at least the following three points can be made:

a. Marx's anthropocentrism

I think it is plain that Marx had an anthropocentric world-view and did not set up moral barriers to the investigation of nature. He clearly was a follower of Enlightenment thinkers like Bacon and Descartes. However, both have become the main scapegoats in ecological literature. Both are accused for having helped to establish a world-view which is in favour of dominating nature. But the modern approach towards nature does not amount to a "violation" of nature. As Bodei has made clear, it was the ancient view of nature which saw in the use of mechanics a violation of nature:

> "Nel mondo antico proprio la macchina è stata spesso concepita come un'alterazione 'contro la natura' dell'equilibrio uomo/natura. Del resto il termine mechané non significa altro, in origine, se non 'astuzia', 'inganno', 'artificio'. Solo più tardi viene a indicare la macchina in genere... La meccanica è quindi considerata da Aristotele e da una parta della

> tradizione come un sapere e una tecnica contro natura (para physin), perché viola le leggi naturali, a differenza della medicina, ad esempio, che è secondo natura (katà physin), in quanto le promuove." (Bodei 1983:17-8)[36]

This view changes with modernity; nature now is seen as an object of utility which fulfills human needs and desires. If nature is harnessed in this project, it is not by violating her laws, but by obeying them. Marx distinguishes between two general forms of mankind's relationship with nature. The first is the form where nature was merely "appropriated", i.e. in societies of hunters and gatherers. In the second form, nature is not only appropriated, but also transformed. In the Grundrisse, he imagines a state in which agricultural communities appropriate "ready objects prepared by nature itself for consumption" (Grundrisse: 492) "without any instruments whatever" (id.). A state of nature may be imagined in which "the free gifts of nature [were] abundant" (Grundrisse:612) and hence there was no need to develop technologies. However, Marx calls this appropriation of nature production and not consumption, since hunters and gatherers also have to develop certain capacities and abilities. But this is not the normal state, not even a normal original state, as he assures in the same text (cp. Grundrisse:492). In Capital, Marx states more explicitly that man can produce nothing without technology

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36 A corollary of the ancient view of nature was the fear that nature might take her revenge if mankind tried to harness her: "Tuttavia, la natura beffata, colta di sorpresa da quei sofisti che sono gli uomini, può vendicarsi e punire chi ha osato sfidarla, chi ha tentato di infrangere le sue leggi eterne." (Bodei 1983:17). We find this thought even in a famous passage of Engels's Dialectic of Nature, and in more drastic forms from a religious strand of the ecological movement: here, nuclear power is simply the work of the devil.

(cp. Capital 1:352; in the Paris Manuscripts he had already spoken of industry "als das aufgeschlagene Buch der menschlichen Wesenskräfte", MEW EB 1:542), and the development of productive forces as largely dependent on geographical factors:

> "Where nature is too lavish, she 'keeps him in hand, like a child in leading reins.' She does not impose upon him any necessity to develop himself. It is not the tropics with their luxuriant vegetation, but the temperate zone, that is the mother-country of capital. It is... the differentiation of the soil, the variety of its natural products, the changes of the seasons, which form the physical basis for the social division of labour, and which, by changes in the natural surroundings, spur man on to the multiplication of his wants, his capabilities, his means and modes of labour. It is the necessity of bringing a natural force under the control of society, of economizing, of appropriating or subduing it on a large scale by the work of man's hand, that first plays the decisive part in the history of industry." (Capital 1:481, amended translation)

This presupposes some ends which the producers have which transcend the "normal" end of providing food and shelter. In this means-ends-relationship, human beings try to get something from nature which is not immediately there, or to manipulate and control natural processes to a certain degree. This higher form of Stoffwechsel presupposes the use of specific technologies. To denote this specific trait of humans, i.e. to be natural beings which are able to "steer" some parts of the rest of nature, Marx used the term of "domination of nature". True, the notion of domination is value-laden, as is the notion of exploitation. However, both offer us a possible description of man's relationship to nature; in the first case where natural gifts are abundant, man can be conceived of as exploiting (in the sense of "usufructing") nature; in the second case where nature is actively transformed, it is harnessed or dominated.

I said above that the concept of "domination" is always linked to a concept of the agents' interests. King Midas, by turning everything he touched into gold, can hardly be said to have "dominated" his citizens, or even his own private life. Marx in one passage of the Grundrisse seems to reject the very idea of the domination of nature, since it would imply the breaking of a free will: "Basically the appropriation of animals, land etc. cannot take place in a master-servant relation, although the animal provides service. The presupposition of the master-servant relation is the appropriation of an alien will." (Grundrisse:500, my emphasis).[37] But the condition of breaking an alien will is a limiting case which is not of very much interest: it does not matter if domination is achieved by breaking or by respecting (or by transforming, influencing, manipulating etc.) an alien will; it is only important that the outcome of domination serves the interests of the dominator. The question of whether nature possesses a will (or a soul) of its own, therefore, is primarily a question of religious interest.

As we saw in chapter 1, contemporary debates on ecology seem to conceive society's relation to nature either as one of harmony or one of conflict. Often the former is seen as the desideratum, whereas the latter is seen as the current dreadful state of affairs. For Marx such an opposition makes no sense at all. In the German Ideology he emphasizes that mankind is always in unity and in struggle with nature:

> [The] unity of man with nature has always existed in industry and has existed in varying forms in every epoch according to the lesser or greater development of industry, and so has the 'struggle' of man with nature, right up to

37 From this it follows that another version of this model (which is usually endorsed by environmentalists) is as problematic: the notion of co-operation with nature - one cannot cooperate with a stone or a cat.

> the development of his productive forces on a corresponding basis. (CW 5:40)

Nature, in Marx, is not anthropomorphous. Nature has no end in itself, it is man who imposes his ends on it.[38] In order to do so, however, he has to respect the laws of nature. Domination does not imply violation: as Bacon put it in the Novum Organon, "nature to be commanded must be obeyed... man, being the servant and interpreter of Nature, can do and understand so much and so much only as he has observed in fact or in thought of the course of nature; beyond this he neither knows anything nor can he do anything." (Bacon 1986:47) This is to say that man imposes his ends on nature, but he cannot harness or manipulate nature in an arbitrary way; he cannot make flour out of green wheat.[39] An ecologist might argue that there exists a natural cycle or natural potential for a flower (in our case) to become a fruit and that men are bound to respect these cycles.[40] But nothing in nature forbids us (to take another example) from not eating the ripe apple, from leaving it on the tree and letting it rot. On the other hand, if the apple is picked too early, this is not detrimental to nature, but to human nature: an unripe apple causes stomach-ache.

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38 Recall Hegel's famous phrase that the cork tree does not grow in order to deliver taps for wine bottles; or Voltaire's that the melon was not designed to be eaten by a family.

39 Cf. again Bacon: "Towards the effecting of works, all that man can do is to put together or to put asunder natural bodies. The rest is done by nature working within." (1986:47)

40 To the question if nature operates in cycles, cf. Reiche (1984); Maurer (1973)

Natural cycles have no teleological structure i.e. no immanent purpose, no stage which is the naturally highest. It is rather just by chance (as a product of "blind evolution) that apples in a ripe state are beneficial to men. But even if we accept the teleological argument for a moment, its absurdity can be shown when we extend its scope and look at other cases. Take the case of rats, insects or bacteria which reproduce quickly and are contrary to man's well-being: here man intervenes if he has the required technology to do so. Man's ends are thus intimately related to his "human nature", a concept which is, as we shall see, crucial to Marx's analysis. But Marx's rejection of a teleological structure to nature does not make him blind with respect to ecological problems. An ecological concern is contained in his general position which views nature as man's inorganic body. This body must flourish if man is to flourish. As Marx writes in the Paris Manuscripts: "Man lives on nature - [this] means that nature is his body with which he must remain in continuous interchange if he is not to die." (CW 3:276) Any careless use of resources, any pollution of earth, water and air which exceeds a certain degree may turn out to be detrimental to the well-being of human beings. The disruption of man's environment makes survival for the human species difficult, if not impossible. Marx considers the following possibilities for such a disturbance:

> Capitalist production, by collecting the production in great centres, and causing an ever-increasing preponderance of town population, on the one hand concentrates the historical motive power of society; on the other hand, it disturbs the circulation of matter [Stoffwechsel] between man and the soil, i.e. prevents the return to the soil of its elements consumed by man in the form of food and clothing; it therefore violates the conditions necessary to lasting fertility of the soil. (Capital 1:474)

Marx is aware of the fact that man and soil are essential for a successful Stoffwechsel; they are the two basic elements of every labour process in every society:

> Wird der Arbeitsprozeß ganz abstrakt betrachtet, so kann gesagt werden, daß ursprünglich nur zwei Faktoren ins Spiel kommen - der Mensch und die Natur. (Arbeit und Naturstoff der Arbeit.) ... So wären Erde und Arbeit die Urfaktoren der Production; die zur Arbeit bestimmten Producte, producirtes Arbeitsmaterial, Arbeitsmittel, Lebensmittel - nur ein abgeleiteter Faktor. (MEGA II.3.1.:87)
>
> Zunächst is der Productionsprozeß des Capitals - seiner stofflichen Seite nach betrachtet, soweit Gebrauchswerte producirt werden - Arbeitsprozeß überhaupt und als solcher zeigt er die allgemeinen Faktoren, die diesem Prozeß zukommen, unter den verschiedensten gesellschaftlichen Productionsformen. Diese Faktoren sind nämlich bestimmt durch die Natur der Arbeit als Arbeit. (MEGA II.3.1.82)

There are two main sources of all wealth, the soil, and labour power. If man wants to prosper, these two also have to prosper. But capitalist production hampers this condition, it "develops technology... only by sapping the original sources of all wealth - the soil and the labourer." (Capital 1:475)

b. Population growth

Sometimes a Malthusian theme reoccurs in the ecological discourse; it is the contention that an increasing number of inhabitants of the earth will be left without the means of subsistence and/or that this will lead to an ever-greater degree of pollution. The first part of the contention is classical Malthusian whereas the second part could be called "Neo-Malthusian"; it was expressed in the first reports of the Club of Rome, for example (cp. Meadows and Meadows 1972). Marx, throughout his work, never stopped

criticizing Malthus's ideas. Consider the following passage from the Grundrisse:

> "Malthus's theory... is significant in two respects: (1) because he gives brutal expression to the brutal viewpoint of capital; (2) because he asserted the fact of overpopulation in all forms of society. Proved it he has not, for there is nothing more uncritical than his motley compilations from historians and travellers' descriptions. His conception is altogether false and childish (1) because he regards overpopulation as being of the same kind in all the different historic phases of economic development; does not understand their specific difference, and hence stupidly reduces these very complicated and varying relations to a single relation, two equations, in which the natural reproduction of humanity appears on the one side, and the natural reproduction of edible plants (or means of subsistence) on the other, as two natural series, the former geometric and the latter arithmetic in progression. In this way he transforms the historically distinct relations into an abstract numerical relation, which he has fished purely out of thin air, and which rests neither on natural nor on historical laws..." (Grundrisse:605-6)

Marx disagreed with Malthus over the alleged different growth rates of natural and human population growth. But he could have agreed that there might arise such limits, since he said that we have to deal with "very complicated and varying relations". True, there is a certain hesitation on the side of many Marxists (and on the side of liberals, too) in acknowledging population growth as problematical since this seems to open the door for dictatorial measures of population control or for imperialist treatment of the "irresponsibility" of third world populations. However, this anxiety seems to me unfounded. If it were true that population growth presents severe problems for the prospering of mankind, one can imagine that there might be non-compulsory solutions which are

feasible as well. But not even the results of demographical research seem to suggest that the planet will suffer in the near future from overpopulation. After all, this is a relative concept which depends on technologies and possibilities to provide the means for life. Uptill now, mankind has succeeded in providing these means for an increasing number; that many people still die from starvation is primarily a result of the present mode of distribution of food. Consider now the Neo-Malthusian argument. In so far an increasing number leads to ecological problems like littering or pollution, the phenomenon can be analysed with the logic of public goods (1.3.6.). To repeat: population growth is a relative notion. Consider a stagnating world-population but a simulataneous concentration of population in certain areas. In this case we would not speak of overpopulation of the globe, but of problems of a large community which has to find a solution for the production of its public goods.

c. Future Generations

The reference to future generations is a comparatively new issue in political philosophy. Bacon, writing in the late sixteenth century, was still of the old opinion that "men must pursue things which are just in [the] present... and leave the future to the divine Providence." (The Advancement of Learning, cited in Passmore 1974:80) As Passmore pointed out, it was in Kant's philosophy that

> "the idea of a duty to posterity assumes, perhaps for the first time, a central place. But although he exhorted [zuraten] men to sacrifice themselves for a posterity which would enjoy the fruits of their toil... Kant had too little confidence in man to suggest that the future is entirely his making. Providence, working through the laws of progress, is still for Kant the principal historical agent." (Passmore 1974:80)

World-views of the 20th century, and especially the ecologically inspired ones, are often committed to the position that only enormous sacrifices could prevent mankind from perishing in a nuclear disaster or in an ecological crisis, thus making sacrifices for posterity inevitable. But if we ask for the arguments which would persuade us to make sacrifices for posterity, what can we supply?

Passmore has dedicated some attention to this problem. It seems that there are 3 possible types of arguments. The first is religious, the second perfectionist, the third utilitarian. Leaving aside the first, I deal with the perfectionist and utilitarian approaches. The perfectionist view was endorsed by Kant and Fichte who thought that man will always strive towards a better world, towards the fulfilment of an ideal society. The utilitarian approach is presented in the Bentham, and Sidgwick, version.[41]

> Bentham, and Sidgwick after him, were fully prepared to admit that we ought to take into account both the probability of the effects of our actions and also their remoteness; in general, we should place the greater emphasis on effects which are near at hand. Although the hereafter as such has the same moral importance as the now, this is not true when account is taken of its uncertainty. (Passmore 1974:84)

Thus the utilitarian view (at least in this version) is not strong enough to ensure a concern for posterity, mainly because we are not able to calculate the probabilities of eventually detrimental actions to future generations. As Passmore concludes: "So even if we accept the principle of impartiality and the utilitarian framework in which it is embedded, even if we accept the view that

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41 Passmore erroneously calls Rawls a utilitarian, see Passmore (1974:86-7).

we ought not so to act as certainly to harm posterity, this does not appear to be a principle strong enough to justify the kinds of sacrifice some conservationists now call upon us to make." (id.)

Beckerman, a straightforward defender of economic growth and economic rationality expresses the myopic view of many economists which has come under attack from the environmentalists:

> "[I]f it can be said that there is a conflict between growth and the environment, it is equally true that there is a conflict between growth and food consumption or clothing consumption, or any other ingredient of current standards of living. In other words, one does not choose between consumption tomorrow and environment today; the choice is between consumption tomorrow and consumption today, irrespective of how consumption today or tomorrow is distributed between the environment and other uses of output." (Beckerman 1974:29)

This quote makes sufficiently clear how economists, on the basis of their utilitarian approach, conceive of ecological problems. If something cannot be expressed in terms of monetary value then it is not likely to be taken into consideration for the calculation of utility or welfare.[42] Beckerman asks "[h]ow should society choose between consumption today and consumption tomorrow?" (Beckerman 1974:27) In his answer, he rather justifies the environmentalists' suspicion towards economics. Firstly, Beckerman posits that "[w]here objectives conflict [such as between consumption today and tomorrow] some criteria have to be worked out for deciding on the optimum compromise between them... Economics shows what these criteria must be in general and what the empirical counterparts of these criteria are in special

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42 In Oscar Wilde's words, a cynic is a person who knows the price of everything and the value of nothing. (I thank Paul Kearns for this reference).

cases." (Beckerman 1974:28) Secondly, in giving an example for his solution, he states: "If a sacrifice of consumption today of £100 for purposes of investing in the environment can only yield an extra £90-worth of future welfare from the environment then it should not be undertaken." (Beckerman 1974:29) The first statement is quite imperialist whereas the second lays bare the method of that imperialism; it rules out the possibility that there might be environmental values which are appreciated "as such", even if on balance there would in fact be such a trade-off as described. The problem with Beckerman's account is not, as he sees it, that the different preferences might be difficult to measure, but simply that he neglects the fact that people might not wish the extinction of an animal species even if its financial value were negligible. The second statement, therefore, presents in a nutshell what is wrong with the economists' approach: their framework does not include human needs which cannot be rendered in economic terms ("preferences" which lead to a market price).

Joan Robinson in her Economic Philosophy put her own scepticism about a concern for future generations in this way:

> This problem cannot be resolved by any kind of calculation based on 'discounting the future', for the individuals concerned in the loss are different... The benefit from their sacrifices will come later and they may not survive to see it. The choice must be taken somehow or other, but the principles of Welfare Economics do not help to settle it. (Robinson 1964: 115)

Consider now the approach of Rawls, who is not concerned with maximization of welfare, utility or happiness, but wants to define the conditions for a just society. The question of future generations can also be analysed by this approach. Rawls argues that the principle of impartiality is too demanding; there is no reasonable argument to demand from the present generation that it share the

available resources with the whole of posterity. But it is quite reasonable to hand on to our immediate posterity a better situation than we have ourselves inherited. Rawls writes:

> Each generation must not only preserve the gains of culture and civilization, and maintain intact those just institutions that have been established, but it must also put aside in each period of time a suitable amount of real capital accumulation. (Rawls 1972:285)

The language of economics ("capital accumulation") is a bit technical here but what is meant is simple: each generation has to hand on to the following one technology, investments in science and education, agriculture etc. Note, however, that the extraction of, say, minerals from the earth is an irreversible act, both as regards the 'loss' of the mineral (in its natural form) and also as regards an eventually aesthetic damage (as would be the case in the destruction of a mountain or a village). In this case all that the present generation can do is hand on a compensation for this loss; this compensation may take the form of improved technology which in turn leads to an increase in productivity which finally leads to higher incomes and/or to a decrease of the average working day. (By the way, I think that in this century this is how irreversible destruction of natural resources has been legitimated). However, I think that Rawls' suggestion is misleading, because it overlooks the fact that the interests of the immediate and all future generations may not coincide, as a simple example can show: there may be a technical solution to storing nuclear waste for the next generation (or even the next two or three generations) but this way of storing may become dangerous for the tenth or hundredth generation.

But how does Marx relate to these approaches? At first sight, none of the outlined approaches contains Marx's position. Marx did not think that any hitherto existing society had or should

have, made sacrifices for posterity. He thought that capitalism anticipated the future in the dreadful way that it wastes human resources :

> "It is, in fact, only at the greatest waste of individual development that the development of general men is secured in those epochs of history which prelude to a socialist constitution of mankind." (MEGA II.3.1.:327, English in original)

Communist society on the contrary, so he thought, would leave the planet to future generations in a better state simply as a result of its pure modus operandi. This is not only a matter of prediction and of "historical laws"; Marx himself expounds it as a duty to unborn generations when he speaks about the duty of the world inhabitants to hand it down to future generations in a better condition:[43]

> From the standpoint of a higher economic form of society, private ownership of the globe by single individuals will appear quite as absurd as private ownership of one man by another. Even a whole society, a nation, or even all simultaneously existing societies together, are not the owners of the globe. They are only its possessors, its usufructuries, and, like boni patres familias, they must hand it down to succeeding generations in an improved condition. (Capital 3:776)

Hence the passage from Capital 3 does contain a statement about facts (and historical prophecy) and an ethical principle. It is difficult to speculate exactly about what his position amounted to,[44] but a probable answer, taking Passmore's scheme for granted

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43 It is thus no ethical argument regarding nature, but an ethical argument regarding human beings (unborn generations).

44 I shall return to the complex question of communist society in chapter 5, below.

is that he was committed to both a utilitarian and a perfectionist view. Since Marx says "future generations", a Rawlsian interpretation seems to be excluded. However, we must keep in mind that Marx did not treat this question in a systematic manner, so he probably did not care too much about the formulation.

But Marx also clearly endorsed a perfectionist view. Together with Fichte and Kant, he shared the belief that mankind would always strive towards greater self-realization, toward the ideal society (see his human nature theory, 2.4. below). Together with the industrialists of his time, he shared the belief that the world is imperfect but can be improved. The good society for Marx is a society which enables the release of all human powers, most notably their communal and creative powers (cf. 2.5.). Since these cannot be defined in advance and once and forall, Marx avoids a static definition of what human needs are or what the communist society would exactly look like; but this much seems clear: communism should be that social form which liberates the human content. This is an indefinite process which finds in a perfectionist view its natural expression. In contrast to Fichte and Kant, Marx offered an account which - so he thought - would explain why mankind would sooner or later be forced to establish that ideal society. This account is contained in his historical materialism, to which I shall turn in chapter 4. On the basis of his materialist conception of history, Marx avoided the ethical tone of Kant and Fichte who could only conceive of a duty, a duty to strive for a better future.

In conclusion, Marx's imperative in the above passage where he conceives of a duty of existing generations to leave the planet in an improved situation is rather an exception to his general line of thought. True, in his early writings Marx accepted the categorical imperative to "overthrow all relations in which man is a

debased, enslaved, forsaken, despicable being" (CW 3:182) but this general principle does not stretch to future generations, once a communist society has been established; it would be sufficient to leave the planet in the same conditions and to take care that mankind will not regress to a state in which man again becomes a foresaken and despicable being.

d. Unintended consequences and the "Tragedy of the commons"

As regards unintended consequences, Marx was one of the first social scientists who systematically treated this mechanism. He employed this kind of analysis himself when he demonstrated both on the political and economical level how individual rationality can bring about collectively undesirable outcomes. As Elster put it:

> The general idea that unintended consequences arise when agents entertain beliefs about each other that exemplify the fallacy of composition is an extremely powerful one. In my opinion, it is Marx's central contribution to the methodology of social science... (Elster 1985:48)

Economists are usually interested in positive feed-back loops which give rise to their beloved "invisible hand mechanisms". But Marx immediately sees the two possibilities contained in this mechanism:

> The real point is not that each individual's pursuit of his private interest promotes the totality of private interests, the general interest. One could just as well deduce from this abstract phrase that each individual reciprocally blocks the assertion of the others' interest, so that instead of a general affirmation, this war of all against all produces a general negation. (Grundrisse:156)

As Elster rightly observed,

> for Marx, counterfinality - the negative externalities of the capitalist mode of production - was a more interesting phenomenon. He believed that capitalism systematically tends to aggravate spontaneously arising crises, since each entrepreneur reacts to them by behaviour that, even if individually rational, is disastrous in the aggregate. The main instance of this mechanism Marx found in the process that according to him tends to generate a fall in the rate of profit. (Elster 1985:25-6)

Marx also employs the same structure of argument with respect to the phenomenon that behind the backs of capitalists a process is at work which, through increasing productivity, reduces socially necessary labour which turns out to lower effective demand. Marx also employs the argument in summarizing the whole capitalist business-cycle, i.e. on a meta-level. Here the specific capitalist means of increasing productivity leads to economic crises. This is one major reason why Marx condemned capitalism: he condemned it as a socially-antagonistic form of wealth production. Certainly, capitalism develops the productive forces (this is, according to Marx, its historical legitimation), but it does so by wasting social wealth. Tremenduous amounts of value are depreciated in periods of economic crisis, and labourers and soil are exploited and degraded during capitalism's "business as usual".

Another example of the presence of this mechanism in Marx's work is the "Tragedy of the Commons" which I referred to in 1.3. Marx comes close to recognizing this mechanism when, in a letter to Engels, he praises the German agriculturalist Fraas for proving

> that climate and flora changed in historic times... He maintains that as a result of cultivation - in proportion to its degree - the "dampness" so very much beloved by the peasants is lost (hence plants, too, emigrate from South to North) and eventually the formation of steppes begin. The first effect of cultivation is useful but is eventually

> devastating on account of deforestation etc... The sum total is that cultivation - when it progresses naturally and is not consciously controlled (as a bourgeois, of course, he does not arrive at this) - leaves deserts behind it, Persia, Mesopotamia, etc. Greece. (Letter to Engels, 25.3.1868)

Now this is clearly a different explanation from the one which blames market mechanisms (or capitalism) for ecological problems. As we have seen in 1.3.5., the market mechanism works in a detrimental way above all in the case of non-renewable resources. In the case of agriculture it is also counterfinality ("tragedy of the commons") which leads to undesired results.

2.2. Marx's motivation for his critique

Fortunately, Marx's approach is far richer in scope than is reflected in the all too well-known standard interpretation which blames only capitalist relations for all evil. Taking Marx in a broader sense seems to me supported by at least two facts. Firstly, Marx's critique of capitalism was no end in itself, but was to serve the establishment of a "true, human society" (see chapter 5). Marx criticised capitalism mainly because of its 'enslaving effects' on human beings. Enslaving effects can express themselves in many ways; it may take the form of overt or covert oppression and it may also take the form of alienation which Marx thought was the prevailing form in the capitalist system. Alienation, however, presupposes a 'true human' essence which will come into being once the conditions of alienation are removed; thus communism is the realization of the true human essence, of true human society. If we take this line of thought as a guiding thread, we have a far richer approach for our subject than a simple 'capital-criticism' would offer us. Marx criticized the social form of capitalism because it alienated men: the

products of their work appear to them as if they were alien powers. In the German Ideology he writes thus:

> This fixation of social activity, this consolidation of what we ourselves produce into a material power above us, growing out of our control, thwarting our expectations, bringing to naught our calculations, is one of the chief factors in historical development up till now. The social power... which arises through the co-operation of different individuals as it is caused by the division of labour, appears to these individuals, since their cooperation is not voluntary but has come about naturally, not as their own united power, but as an alien force existing outside them, of the origin and goal of which they are ignorant, which they thus are no longer able to control, which on the contrary passes through a peculiar series of phases and stages independent of the will and the action of man, nay even being the prime governor of these. (German Ideology:47-8)

As Fetscher summarized Marx's concern:

> Domination of man over 'social nature' should do away with the quasi-natural forces generated by the capitalist system of production. Thus the 'free association of producers' is at the same time the prolongation and the accomplishment of human history as the humanization of nature and of the appropriation of truly humanized nature by man. (Fetscher 1973:460)

But it is not only capitalism which brings about alienation; there are other social forms which display this feature; and it seems doubtful to many that alienation can ever be overcome. This is in part due to the character of our complex world of technology and social institutions. If this is so, might not Marx's own approaches give us illuminating insights into this field? If so, much of my task would be fulfilled, viz. showing how useful Marx can be in analysing ecological problems. Marx treats technology as a constituent part of mankind in prominent places

throughout his work (see chapter 3). He thus offers an analytical tool for investigating ecological problems. [45] The other tool consists in his social theory which investigates the features of social institutions. As we shall see, Marx focused on this subject as well in the most prominent places throughout his work and, what is more, he combined both aspects in a theoretical framework which has been called "historical materialism" (see chapter 4).

Now it would be beside the point to blame a writer for having written on problems which were pressing at his time. But, unfortunately, it seems that sometimes contemporary Marxists are unable to acknowledge the changed reality in a deep way (of course, even the most orthodox Marxist will pay lip-service to the fact that reality has changed...) and to build their theory on these changed "real" preconditions. Moreover, they have blinded us to an approach which is able to deal with contemporary problems (such as ecology) in an illuminating way. Thus I plea for a re-interpretation of Marx in this respect which acknowledges frankly Marx's own predominant approach (i.e. blaming capitalism's social form) but does not accept it as the main tool in analyzing ecological problems. In order to do so, we have to exploit some resources in Marx's thought which have not yet been acknowledged to the extent they deserve.

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45 It is not surprising that he did not consider inherently dangerous technology or high-risk systems. For one reason, he wrote over a hundred years ago and could not witness the problems of modern technological systems. For the other reason, he seemed to have been quite confident regarding the possibilities of overcoming technical problems which have detrimental effects on human beings. Instead, he insisted that it was the capitalist use of technology which makes life unpleasant and risky.

Moreover, as my analysis will show, Marx himself in his preparatory writings for Capital analysed machine-technology in a way which focused on its inherent characteristics, regardless of the capitalist context in which it was placed. Orthodox Marxism has blinded us to such theoretical possibilities by stressing the paramount role of capitalist exploitation and class rule as causing all major problems in the Modern World. Such a narrow and, confronted with the facts, unrealistic, interpretation of Marx's thought may have the advantage of being in line with the argument in Capital. But in neglecting other most interesting parts of his theory, and overlooking ecological problems in socialist countries, they have done a disservice to Marx's thought, convincing many of their opinion that his theory has little to offer in respect to contemporary problems.

2.3. Three Marxist approaches

In 2.1. I have tried to relate some of Marx's statements to contemporary debates on ecological problems. In what follows, I shall present three approaches which are to be found in Marx's writings, all of which could be related to ecological problems. The first approach blames capitalist production (2.3.1.), and the second alienation for ecological problems (2.3.2.). The third approach is more general in that it investigates natural and social factors without focussing immediately on the capitalist form (2.3.3.). I shall claim that this is the most promising approach and I use it as the basis for my own argument.

2.3.1. First approach: capitalist production as a cause of ecological problems

In its concentration upon capitalist profit-maximizers, Marx's approach is fairly close to the "externalities approach" (see 1.3.6.) with one difference: Marx's main focus is on capitalists as externalizers. As we have seen in ch.1, however, the scope of the phenomenon is much wider: state-enterprises and private consumers, too, externalize their costs, following general standards of rationality. The potential of public enterprises for causing ecological problems is as great as that of private enterprises, if they employ high-risk technology. The same holds true for state enterprises in socialist countries. Let us determine, then, the potential of private consumers for damaging the natural environment. Imagine the following possibilities: littering, private cars, and burning. In the case of littering, most civilized countries employ public services to remove refuse. The responsibility lies thus with the state (public organs) which has to provide a solution to the problem (burning waste etc.). Individual citizens pay a fee for obtaining this service. Marx saw the possibility of private pollution but tried to tie it to the capitalist economy, i.e. saw it as being caused by irrational social principles:

> Excretions of consumption are of the greatest importance for agriculture. So far as their utilisation is concerned, there is an enormous waste of them in the capitalist economy. In London, for instance, they find no better use for the excretion of four and a half million human beings than to contaminate the Thames with it at heavy expense. (Capital 3:101, my emphasis)

Marx assumes that a rational society would find a solution for using excrement as a fertilizer for agriculture. Up to now, however, there is no solution available in this respect. Human excrement is simply not appropriate for fertilizing agricultural land.

A widespread view of environmentalists is that private consumers ought not to buy potentially damaging goods, such as batteries, plastics, cars, etc., in order to abolish this kind of refuse and to allocate the productive capacities of society to other, less damaging, production. This argument forgets the structural aspect of the problem: it forgets the 'embeddedness' of virtually every consumer in a network of social obligations, technological and economic constraints and possibilities, which by and large reproduces the present structure of consumer goods. To be sure, the market mechanism would allow for the substitution of presumably dangerous materials with less dangerous material, if the new material could be produced at competitve prices. But this depends on technological possibilities which are economically profitable (I leave aside here the political aspect, see chapter 3). The environmentalist, confronted with such an argument, would probably confess his readiness to pay much more for a certain good, if this would protect the environment. This solution, however, again raises the spectre of the Prisoners' Dilemma. We can regard it as a solution only under two premises: (a) that the real income allows for such choices; (b) that the vast majority of people would become what Pizzorno has called "identifiers".[46] But note, this "solution" only reformulates our problem: for people to adhere to a "logic of identity" rather than to a "logic of utility", they would have to accept some sort of "green" ideology and enter a circle of recognition which is constituted by other committed environmentalists.

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46 Starting from Hirschmann's notions "exit, voice and loyality", Pizzorno introduces a fourth notion: identification. This is supposed to explain behaviour which otherwise could not be explained. See Hirschmann (1970) and Pizzorno (1986).

In the case of private cars, at least some countries have introduced technical standards which limit the quantity of toxic gas in car exhaust. In countries where no such legislation exists, the potential for private pollution is considerable. Take now the problem of private burning. Especially in winter time the big cities of many countries are covered by an unbreathable air. A change in this situation is not very likely since every individual consumer seems to prefer breathing bad air to freezing. Even given the existence of a new, clean heating technology, this attitude of the 'rational consumer' would not change unless special incentives are created which 'force' people to change their heating systems. But in many towns, heating is provided by public services (central heating plants), hence shifting the responsibility again from the individual to the social level.

To sum up, then, two things can be said. Firstly, the situation of private consumers is sometimes characterized by the fact that their environmental responsibilities are taken over by public administration. Secondly, the impact of private consumers on the environment is of much less importance (with the possible exception of private cars) than the impact of the other mechanisms listed in 1.3. This is so because the scope of private pollution is much more restricted, because the technology at hand is much less powerful. In conclusion, we can say that Marx underestimated the externalizing potential of public enterprises (and, to a lesser extent, of private consumers). Marxists after him have been mistaken to underestimate the externalizing potential of socialist enterprises.

In the early On the Jewish Question Marx connects the degradation of nature to the dominion of money:

> Money is the jealous God of Israel in face of which no other god may exist. Money is the universal self-established value of all

> things. It has therefore robbed the whole world - both the world of men and nature - of its specific value... The view of nature attained under the dominion of private property and money is a real contempt for and practical debasement of nature..." (CW 3:172)

As we already saw above, Marx accuses capitalist production for the interruption of the man-nature metabolism: "... on the other hand, it [i.e. capitalist agriculture, R.G.] disturbs the circulation of matter [Stoffwechsel, R.G.] between man and the soil i.e. prevents the return to the soil of its elements consumed by man in the form of food and clothing; it therefore violates the conditions necessary to lasting fertility of the soil." (Capital 1:474) In the following passages Marx demonstrates how he applies the working of capitalist principles to its own life-conditions, the soil and the labourer. Here his explanation is clearly one which rests on the "unintended consequences mechanism", although Marx himself tries to limit it to the capitalist epoch.

> [A]ll progress in capitalistic agriculture is a progress in the art, not only of robbing the labourer, but of robbing the soil; all progress in increasing the fertility of the soil for a given time, is a progress towards ruining the lasting sources of that fertility. The more a country starts its development on the foundation of modern industry, like the United States, for example, the more rapid is the process of destruction. Capitalist production, therefore, develops technology, and the combining together of various processes into a social whole, only by sapping the original sources of all wealth - the soil and the labourer. (Capital 1:474-5, my emphasis)

In Capital 2 Marx dedicates some attention to the problem of timber-growing:

> The long production-time (which comprises a relatively small period of working time), and the great length of the periods of turnover entailed, make forestry an industry of little

> attraction to private, and therefore capitalist, enterprise, the latter being essentially private even if the associated capitalist takes the place of the individual capitalist. The development of culture and of industry in general has ever evinced itself in such energetic destruction of forests that everything done by it conversely for their preservation and restoration appears infinitesimal. (Capital 2:248)

However, as we have seen above, the absence of the profit principle, and the absence of market competition, does not ensure a careful use of natural resources. Marx often seemed to take into account this possibility incidentally, without elaborating on it. Rather, it came to Marx via the reading of Fraas. As Fetscher has observed, Marx was deeply inspired by Fraas whose book Klima und Pflanzenwelt in der Zeit, ein Beitrag zur Geschichte beider he 'discovered' in 1868 and about which he commented to Engels enthusiastically, as we have seen above. (Fetscher 1985:124)[47] Therefore, both the problems of fertility and forestry illustrate the mechanism of unintended consequences and the "tragedy of the commons", rather than capitalist methods. Consider, first, the forestry example. Marx's claim is that forests have been destroyed throughout history, no matter under which form of property. This is to say that not only the market mechanism or capitalist methods of production lead to destruction of forests but also collective forms of growing timber. Consider, now, the fertility example. Here Marx juxtaposes a short-term rationality ("increasing the fertility for a given time") to a long-term irrationality ("ruining the lasting resources of that fertility") where the latter is explained by the former. This interpretation is further

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47 See, also, his appreciation of Liebig, cf. Capital 1:475: "To have developed from the point of view of natural science, the negative, i.e. destructive side of modern agriculture, is one of Liebig's immortal merits."

supported by Marx's general assertion that "the development of culture and industry in general" (Letter from 25.3.1868) has led to such an energetic destruction of forests.

But let us turn again to the general destruction of soil and labour as a result of the capitalist mode of production:

> Large-scale industry and large-scale mechanised agriculture work together. If originally distinguished by the fact that the former lays waste and destroys principally labour power, hence the natural force of human beings, whereas the latter more directly exhausts the natural validity of the soil, they join hands in the further course of development in that the industrial system in the country-side also enervates the labourers, and industry and commerce, for their part, supply agriculture with the means of exhausting the soil. (Capital 3:813, amended translation)

With regard to the destruction of labour we find the following statements:

> Après moi le déluge! is the watchword of every capitalist and of every capitalist nation. Hence capital is reckless of the health or length of life of the labourer, unless under compulsion from society. To the outcry as to the physical and mental degradation, the premature death, the torture of over-work, it answers: ought these to trouble us since they increase our profits? (Capital 1:257)

In illustrating what the consequences of capitalist production amount to for the worker, he says:

> At the same time that factory work exhausts the nervous system to the uttermost, it does away with the many-sided play of the muscles, and confiscates every atom of freedom, both in bodily and intellectual activity. The lightening of the labour, even, becomes a sort of torture, since the machine does not free the

> worker from work, but deprives the work of all interest. (Capital 1:398)

Two things spring immediately to mind:

(1) Marx concentrates far more on the waste of labour than on the waste of the natural environment;

(2) The waste of the natural environment in Marx's view is largely limited to the waste of land as a result of capitalist agriculture. The last point deserves a further comment.

Marx is fairly optimistic regarding the possibilities of recycling. In Capital 3, he stresses the fact that capital has an interest in consuming the elements of production in an economic way:

> The general requirements for the re-employment of these excretions are: large quantities of such waste, such as are available only in large-scale production; improved machinery whereby materials, formerly useless in their prevailing form, are put into a state fit for new production; scientific progress, particularly of chemistry, which reveals the useful properties of such waste. (Capital 3:101)

Regarding the chemical industry Marx is completely optimistic. He generally states that this industry recycles its own excrement.

> The most striking example of utilizing waste is furnished by the chemical industry. It utilizes not only its own waste for which it finds new uses, but also that of many other industries. (Capital 3:102)

The general result of Marx's analysis with regard to "undermining the fountains of wealth" is formulated in the following pointed manner:

> Capitalist production ... is very economical with the materialized labour incorporated in

> commodities. Yet, more than any other mode of production, it squanders human lives, or living labour, and not only blood and flesh, but also nerve and brain. (Capital 3:88)

See also the 1861-63 Manuscripts:

> The capitalistic production is ... most economical of realized labour, labour realized in commodities. It is a greater spendthrift than any other mode of production of man, of living labour, spendthrift not only of flesh and blood and muscles, but of brains and nerves. (MEGA II.3.1.:326-7, orig. Engl.)

As we saw above, Marx distinguished between two sources of wealth: soil and labour. That Marx's main interest was in the waste of human beings is not due solely to his humanist standpoint and his political outlook. Undoubtedly it reflects the historical situation of his time where the far more pressing problem was the direct waste of human beings in the production process. Nowadays, human beings are endangered perhaps less within the industrial production process than outside it. Marx was preoccupied with the life-conditions of the working class resulting from overwork and bad working conditions. There was a remedy at hand which in fact improved the working conditions and the lives of the working class and which Marx supported: the labour-legislation which led to the shortening of the working day which introduced, inter alia, standards of job security. What if we apply this by analogy to the destruction of the natural environment? Imagine two clear cut cases. The first is a production process in which human beings are wasted, but which, ecologically, does little damage. The second is a production process in which labourers enjoy safe and decent working conditions, a short working time, but which harms the natural environment. If we take these two cases as ideal cases and suppose - for the sake of the argument - that the first obtained during Marx's time, whereas the second obtains today, we might

benefit from an explicit application of Marx's approach to the natural environment.

Before proceeding any further, we must ask: how exactly does Marx conceive of the exhaustion of labour power? In the opening paragraph of section 5, chapter X of Capital, Vol. 1, he writes:

> "What is a working-day? What is the length of time during which capital may consume the labour power whose daily value it buys? How far may the working day be extended beyond the working-time necessary for the reproduction of labour power itself?" It has been seen that to these questions capital replies: the working-day contains the full 24 hours, with the deduction of the few hours of repose without which labour-power absolutely refuses its services again. (Capital 1:252)

Capital does not respect the time necessary for human education, intellectual development, fulfilment of social functions, social intercourse, the free play of physical and psychical life-powers. It does not even respect the holy Sabbath (cf. id.). Following its blind instincts, capital overruns not only the moral, but also the physical, limits of the working day: all the worker's "disposable time is by nature and law labour time" (id., my emphasis)

If we apply this argument to man's dealing with nature, we would get the following argument: nature belongs to man "by nature and law" in its entirety; man overruns the "moral and physical limits" of nature; man often does not permit nature to recover. In fact, Marx himself says that "a greedy farmer snatches increased produce from the soil by robbing it of its fertility." (Capital 1:253, my emphasis)

As we have seen, Marx invokes moral and physical limits when speaking about the working day and its limits. Does it make sense

to do the same with respect to nature? As regards the moral dimension, I think that Marx would have refused. He time and again ridiculed all forms of nature worship and sentimentalism. This becomes clear when we look at his appraisal of capitalism, in so far as it "creates the bourgeois society, and the universal appropriation of nature." (Grundrisse:409)

In a polemic against the "true socialists" (German Ideology) Marx makes fun of a view which sees harmony essentially in nature:

> "'Man' enters the realm of 'free nature' and utters, among other things, the following tender effusions of a true socialist's heart: '... Gay flowers ... tall and stately oaks [...] forest birds... [...] I see [...] that these creatures neither know nor desire any other happiness than that which lies for them in the expression and the enjoyment of their lives..." (CW 5:471)

Marx comments:

> "'Man' could also observe a great many other things in nature, e.g., the bitterest competition among plants and animals; ... he could further observe that there is open warfare between the 'forest birds' and the 'infinite multitude of tiny creatures'..." (CW 5:471)

Another example of Marx's fierce rejection of any "nature cult" is the following polemic against Daumer. Marx comments on the following two passages from Daumer's Die Religion des neuen Weltalters:

> "Nature and woman are really divine, as distinct from the human and man... The sacrifice of the human to the natural, of the male to the female, is the genuine, the only true meekness and self-externalisation, the highest, nay, the only virtue and piety." (as cited in Marx, CW 10:244)

Daumer then cites Stolberg's poem "An die Natur":

Nature holy, Mother sweet,
In Thy footsteps place my feet.
My baby hand to Thy hand clings,
Hold me as in leading strings!

and comments: "Such things have gone out of fashion, but not to the benefit of culture, progress or human felicity." (ibidem) Now look at Marx's outrage:

> Herr Daumer's cult of nature ... is a peculiar one. He manages to be reactionary even in comparison with Christianity. He tries to restore the old pre-Christian natural religion in a modernised form... We see that this cult of nature is limited to the Sunday walks of an inhabitant of a small provincial town who childishly wonders at the cuckoo laying eggs in another bird's nest..., at tears being designed to keep the surface of the eyes moist..., and so on... There is no mention, of course, of modern natural science, which, with modern industry, has revolutionised the whole of nature and put an end to man's childish attitude towards nature as well as to other forms of childishness. But instead we get mysterious hints and astonished philistine notions about Nostradamus' prophecies, second sight in Scotsmen and animal magnetism. For the rest, it would be desirable that Bavaria's sluggish peasant economy, the ground on which grow priests and Daumers alike, should at last be ploughed up by modern cultivation and modern machines. (CW 10:245, my emph.)

Instead of this sentimental notion of nature, Marx praises Hobbes and Hegel for a realistic view of nature:

> "Hobbes had much better reasons for invoking nature as a proof of his bellum omnium contra omnes, and Hegel, on whose construction our true socialist depends, for perceiving in nature this cleavage, the slovenly period of the Absolute Idea, and even calling the animal the concrete anguish of God." (CW 5:473)

What is interesting here is that Marx attacks an argument about nature which is also present in contemporary ecological discourse.

The argument is that nature prescribes for society how to live (see chapter 1). Marx's polemic seems to have been written directly against someone we know personally:

> "The true socialist proceeds from the thought that the dichotomy of life and happiness must cease. To prove this thesis he summons the aid of nature presupposing that this dichotomy does not exist in nature and from this he deduces that since man, too, is a natural body and has the properties which bodies generally possess, this dichotomy ought not to exist for him either." (CW 5:473)

We can think of nature either as having instrumental or intrinsic value. As Passmore put it: "On the first view, wilderness and species ought to be preserved only if, and in so far as, they are useful to man. On the second view, they ought to be preserved even if their continued existence were demonstrably harmful to human interests." (Passmore 1974:101) He rightly says that "usefulness need not to be narrowly interpreted: wilderness and species, it might be argued, are valuable not only as economic resources, actual and potential, but as providing opportunities for the pursuit of science, for recreation and retreat, as sources of moral and aesthetic delight." (ibidem,102) It thus seems a promising project to develop arguments against the destruction of the natural environment on the basis of its instrumental rather than its intrinsic values; the more so, since Marx's position connects the aspect of domination of nature to human interests.

Marx, drawing an analogy between exhausted working power and exhausted soil used an instrumentalist argument in the example of the greedy farmer. Yet another observation can be made about this example. He did not say that the exhaustion of soil was due only to capitalist methods, but due also to the greedy behaviour of the farmer. Of course, as we have seen above (Capital 1:474-5; Capital 3:813), that Marx thinks that capitalist methods accomplish the

destruction of soil in the most systematic and 'efficient' way. But his reference to the 'greediness' of the farmer suggests that it is a fundamental problem that must be faced by every social form. In similar fashion, Marx analyses the labour process in its material content ('as such') before he dedicates his attention to the specific social forms (above all, the capitalist one).

> "Zunächst is der Productionsprozeß des Capitals - seiner stofflichen Seite nach betrachtet, soweit Gebrauchswerte producirt werden - Arbeitsprozeß überhaupt und als solcher zeigt er die allgemeinen Faktoren, die diesem Prozeß zukommen, unter den verschiedensten gesellschaftlichen Productionsformen. Diese Faktoren sind nämlich bestimmt durch die Natur der Arbeit als Arbeit." (MEGA II.3.1.82)

With such an approach one does not say that capitalism exhausts nature just like it exhausts labour power, but that human beings (sometimes) exhaust nature just like the capitalist exhausts labour power. In both cases the exploiter has to face negative consequences if he is too ruthless. During Marx's time capitalists resolved the problem of a perishing labour force by importing new labour (of course, labour legislation put an end to this, see Capital 1). In the case of man's exploitation of nature we can distinguish two cases, recalling the distinction between the "Prisoners' Dilemma" and the "Assurance Game" in chapter 1. The point of the PD is the following: If the assurance mechanism does not work, optimal outcomes are only obtained by superior force i.e. when all actors are "forced" to contribute to the public good either in a direct way (penal law) or in an indirect way (selective incentives). Before considering this possibility, let us look briefly at the possibilities for cooperation. As Shaw (1984) has pointed out, the number of the actors must be limited and the game must be repeated. Taking a limited numbers of actors for granted, the repetition of the game does not necessarily give an incentive to contribute to the public good: if an actor is

better off by polluting and can off-load the costs onto "the public", then he will not cooperate. In this case, the future is likely to become the "junkyard of the present" (Müllhalde der Gegenwart) as Preuss (1981) aptly remarked. If, however, the future "retroacts" even now, and if it can be anticipated in some way, actors may have an incentive to cooperate. But note that it is only in the case of this feed-back loop where detrimental consequences become felt, that a further discounting of the future is likely to be avoided.[48]

In conclusion, then, there is no mechanism which automatically secures an optimal outcome. Let us therefore discuss an alternative: law coerces actors to cooperate. Can law provide the key to the solution of ecological problems? I am aware that the existence of a law does not in principle alter anything with respect to the behaviour of rational actors; the problem would be restated in the form that it might be rational for the actors to break the law. Here I simply assume that negative incentives (threat of sanctions) are at work which prevent actors from doing so.

For the purpose of exposition we may take Dworkin's (1978:171) distinction between three approaches of modern law: rights-based theories, duty-based theories[49] and goal-based theories. The first and second are mainly concerned with individual interests;

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48 As Ch. Perrow pointed out to me, it is essentially human to act within short time-spans and to consider only short-term consequences of that action. But the present time with its immense and fast information- and communication-systems may allow for a readiness to think in longer time-spans, a readiness which has never existed before.

49 Hart (1968) claimed that the duty-based approaches often turn out to be utilitarian, i.e. goal-based (personal communication with Sean Smith).

the third concerns the community as a whole (cf. also Waldron 1984:12-4). In elaborating the first approach, there have been contemporary efforts to extend the concept of rights to animals[50], to material objects in nature[51], to artistic creations and to foetuses[52].

It seems pretty clear that Marx would have ridiculed the rights-based theories. From what we know, he was already opposed even to the rather limited concept of rights in his own time (see his On the Jewish Question; see also Campbell 1983 and Lukes 1985 for an evaluation). With respect to a duty-based theory, Marx, at least in his early Hegel-critique, inspired by Kant's categorical imperative (which is taken as a basis in many contemporary duty-based theories), formulated his own categorical imperative: "The criticism of religion ends with the teaching that man is the highest being for man, hence with the categorical imperative to overthrow all relations in which man is a debased, enslaved, forsaken, despicable being..." (CW 3:182; cf. also ibid.:187) As we shall see in the next section on Marx's philosophical anthropology, Marx in fact did endorse some ethical values which he thought to be universally human and which an ideal form of society should set into practice. The problem for him was thus not to attribute rights but to establish the conditions under which the man's species power could be released. In Lukes's formulation: Marx opposed the morals of "Recht", but endorsed the morals of emancipation.

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50 T. Regan and P. Singer (1980); the first attempt was formulated in 1892 by Salt (cf. Passmore 1974:115)

51 Stone (1974). I am indebted to Andrew Clapham for these references.

52 Feinberg (1974).

But what about the third possibility of a "goal-based theory"? This approach, which dates back to Bentham, is essentially based on utilitarian premises. Since we know how much Marx ridiculed Bentham ("Genie in der bürgerlichen Dummheit") and his "utility-principle" ("freedom, equality, property and Bentham!") it seems unlikely that he would have allowed his own theory to be characterized in goal-based terms. And yet, there is something there which comes very close to an utilitarian approach. I made the distinction above between nature's instrumental and intrinsic values of nature. Marx, so I claimed, adhered to the instrumental view (and was right to do so). But what label other than utilitarian (if only in the broadest sense of its meaning) could be given to this approach?[53]

Let me return to the question of law. In the previous paragraphs I have dealt with a possible Marxist position regarding law's capacity to deal with ecological problems. The result was that Marx probably would have endorsed a goal based and a duty based approach. Consider, for example, his advocacy of labour legislation. At face value his argument is purely goal based (the working class is the universal class which leads mankind into communism). But since Marx thinks that letting people work to death is simply inhuman, he also endorsed a duty based theory. In what follows I shall concentrate upon the feasibility of the goal based approach.

Recent research suggests that the complexity of many problems makes it extremely difficult for law to achieve the intended results: law can rarely anticipate the development of science and

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53 See Lukes (1985) for some similarities between Marx's and utilitarian approaches.

technology, which would be necessary for it to intervene successfully; moreover, legal interventions may produce unintended consequences which also harm nature (see chapter 5).

As Teubner and Willke have pointed out, traditional law was apt to regulate simple, bi-polar conflicts (cf. Teuber/Willke 1984). These conflicts presupposed a world of simple connections. In a stratified society, this condition did in fact obtain (at least to a much greater degree than under present societal forms). Teubner and Willke assume that the structural principle of modern societies is no longer in stratified or class-based society, but a functionally differentiated one.

> Diese 'große Transformation' (Polanyi) und der ihr zugrundeliegende Prozeß der 'Rationalisierung' (Weber) führte zu einem Grad an interner Komplexität moderner Gesellschaften, welcher die Bedingungen und Folgen sozietaler Entwicklung und Steuerung grundlegend veränderte." (Teubner/Willke 1984:9)

Law is confronted with a functionally differentiated, complex society; it follows that it cannot intervene in the traditional way, it cannot 'plan' society. This is not possible, because the social sub-systems have gained an autonomy and degree of differentiation which makes it impossible for law to bring about only intended consequences. There is the ever present danger that interventions in one sub-system have detrimental effects on other sub-systems. Hence the slogan 'more law!' may backfire. But neither does the opposite possibility seem feasible, because the mere autonomy ("Selbstlauf") of sub-systems produces ecological risks and damage.[54]

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54 In chapter 1, we encountered Merton's statement that there are three main types of unintended consequences: functional, dysfunctional and irrelevant. Teubner's "regulatory trilem-

...

Given these difficulties the (neo-)liberal solution comes up with a comparatively simple solution: it assumes that the market leads to beneficial results for nature as well as for society. Marx employed such a solution only in his analysis of the waste of resources (see above). However, many still regard it as a mechanism which is generally valid.[55] As we have seen in chapter 1, the waste of resources is not the most urgent problem for modern societies, and this may indeed be due to the working of the market. But Marx was already well aware that the working of the market offers no beneficial solution for the problems of agriculture and human labour-power. Recalling the discussion in chapter 1, we can conclude that every naive reliance on the market is completely fallacious.[56] Summarizing the discussion of goal-based theories in law, we can say that this approach is linked to the problem of 'steering society' (with all its inherent difficulties). Since a successfully-planned society was Marx's final aim, I shall return to this question in chapter 5.

2.3.2. Second approach: Alienation

...

ma" has it that law as a social system may (1) cause dysfunctional effects in other social systems, (2) remain irrelevant and (3) cause detrimental effects for itself (see Teubner, 1987).

55 See Hayek (1973-79) as the most prominent defender of this position.

56 Note that the dogmatic Marxist and the neo-liberal views are symmetrical, but equally mistaken: the one blames the market as one cause of ecological problems, the other praises the market for being the most efficient remedy.

In 2.3.1. I concentrated on detrimental effects stemming from capitalist production, especially from its profit principle. I dismissed that principle as too narrow to be able to account for ecological problems. Next, I evaluated the question of private consumers as "externalizers", i.e. as responsible for ecological problems and arrived at a similar result. Another prominent feature of capitalism which Marx holds responsible for many pathological phenomena of modern society is alienation. Might it not be that under conditions of alienation a careless use of technology and resources takes place which leads to ecological problems? Marx does not elaborate upon this line of thought in a systematic way. However, in Capital 3, in the chapter entitled "Economy in the Use of Constant Capital", he states:

> Finally, we have seen earlier that, in fact, the labourer looks at the social nature of his labour, at its combination with the labour of others for a common purpose, as he would at an alien power; the condition of realizing this combination is alien property, whose dissipation would be totally indifferent to him if he were not compelled to economise with it. The situation is quite different in factories owned by the labourers themselves, as in Rochdale, for instance. (Capital 3:85, my emphasis)

With the idea of being "compelled", Marx has in mind the institution of piece-work (Stücklohn) as the following passage makes clear:

> The capitalist's fanatical insistence on economy in means of production is therefore quite understandable. That nothing is lost or wasted and the means of production are consumed only in the manner required by production itself, depends partly on the skill and intelligence of the labourers and partly on the discipline enforced by the capitalist for the combined labour. This discipline will become superfluous under a social system in which the labourers work for their own account, as it has

> already become practically superfluous in piece-work. (Capital 3:83)

Note that communist society and capitalist piece-work are supposed, here, to be similar in their results: both tend to economise on resources. In both cases, the worker has no interest in wasting resources. The principle of piece-work is said to bring about this result because the worker gets paid for the fruit of his labour according to their quantity and quality. Thus it lies in the worker's interest to produce a maximum output in a certain time period. Capitalists' supervision can therefore be minimized. But here Marx seems to overlook a crucial fact. Since the worker gets paid for the final product, he has no incentive to use resources sparingly. If he squanders resources this need not have negative consequences for his wage. His wage could, however, be related to his use of resources in the following two ways: either the worker has to pay for wasted raw material, semi-products or damage to the machine (as can easily be done in the case of house work), or supervision and control are maintained. A communist society, therefore, is not free from this problem either (see 1.3.5.). The possibility of alienation arises as soon as we admit that singular interests are not identical to general interests[57], a possibility which Marx excluded. I return to this problem in chapter 5 again.

2.3.3. Third approach: Man-nature-metabolism

In 2.3.1., I introduced industry and technology as decisive factors with respect to ecological problems. "Production" thus seems to be the central category for the analysis of our problem. We are confirmed in this view by a statement from a radical

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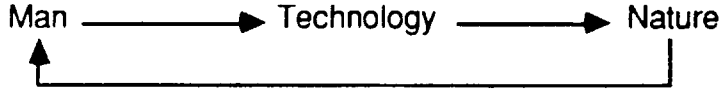
57 A further cause of ecological problems has been called "technological alienation" and will be discussed in chapter 3.

ecologist who said: "For the sake of nature, no production would be the best production." (Amery 1978:167, my translation). This position, however, leads to absurdity. Human beings would no longer exist if they stopped producing their life-conditions within nature. [58] Marx's approach is far from such absurdity. He recognizes that human beings are part of nature, the most developed species of animals. They are thus dependent on nature, and have to organize their "interchange" (Stoffwechsel) with nature in order to survive. Furthermore, they employ tools, instruments, knowledge and skills during their interaction with nature. Let us call this "technology" for short. He locates technology in the middle between man and nature: it is the necessary condition for man's Stoffwechsel with nature; man transforms nature only by using means, tools, technology.

> "Technology discloses man's mode of dealing with nature." (Capital 1:352) "But just as man requires lungs to breathe with, so he requires something that is work of man's hand, in order to consume physical forces productively." (Capital 1:365)

Fig. 2



58 And yet, even on this level, the argument has been put forward that, if mankind inevitably damages nature in securing its means for life, it would be better that it perish (cf. Birch 1982:48-9).

Technology is the mediating instance without which man could not secure his interchange with nature. Marx's approach is essentially based on Hegel:

> As soon as he has to produce, man possesses the resolve to use a part of the available natural objects directly as means of labour, and, as Hegel correctly said it, subsumes them under his activity without further process of mediation." (Grundrisse:734) And: "Nature builds no machines, no locomotives, railways, electric telegraphs, self-acting mules etc. These are products of human industry; natural material transformed into organs of the human will over nature. They are organs of the human brain, created by the human hand; the power of knowledge, objectified." (Grundrisse:706)[59]

There are several questions then which need examination before we can address Marx's position in its full scope. The first is the question of nature, to which I turn in the next section (2.4.); the second is the question of huuman nature (2.5.) Finally, the question of technology will be addressed in chapter 3. After this discussion, we will be in a better position to examine Marx's thought with respect to ecological problems; I shall then take up again the threads of nature, technology and society and discuss them as they are brought together in Marx's historical materialism (chapter 4).

2.4. The concept of nature

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59 Cf. Hegel: "Der Mensch hat Ursache, auf seine Werkzeuge stolz zu sein, denn die Vernünftigkeit ist darin ausgedrückt. Das Werkzeug bildet den medius terminus, wodurch die Tätigkeit des Menschen mit der äußern Natur vermittelt wird. Es ist dies der Geist der Vernunft, daß der Mensch, indem er ein anderes nach außen kehrt und abreiben läßt, sich selbst erhält." (Hegel 1983a:159)

In this section I claim that Marx's concept of nature belongs to a discourse which dates back to Bacon and which includes such thinkers as Hegel and Nietzsche.[60] It is this modern view of nature which has structured philosophical reasoning and which has recently come under attack. As we shall see, Marx did not merely follow Bacon or Hegel, but developed a quite unique position, however much the "modern" concept of nature is at its basis. Therefore, in discussing Marx's approach, the whole modern concept of nature is involved.[61] A position such as the fundamentalist ecological position which refutes the Marxian position is thus

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60 From Bacon ("nature is a storehouse of matter"), Hegel ("nature has no immanent purpose"), Marx ("nature ceases to be recognized as a power for itself") there is a direct line to Nietzsche ("will to power"). For an exposition of this discourse and its historical emergence, see Leiss (1972). But Marx is also different from these writers who propound that man should make an impact on the world: for Marx this goal is related to the goal of controlling all natural and social processes (see ch.5).

61 Cf. Heidegger (1961): "Das Zeitalter, das wir die Neuzeit nennen, ... bestimmt sich dadurch, daß der Mensch Maß und Mitte des Seienden wird. Der Mensch ist das allem Seienden, d.h. neuzeitlich aller Vergegenständlichung und Vorstellbarkeit zugrundeliegende, das subiectum." (Cited in Habermas 1985:160) It is also Heidegger who challenges the modern concept of nature as a "storehouse of matter and energy" (cf. Heidegger 1978:296-9). Modern science, like modern technology, entraps and enframes nature. The alternative is to hope that another form of poiesis will "bring forth and reveal": art. Heidegger's vision lies in "this other possibility: that the frenziedness of technology may entrench itself everywhere to such an extent that someday, throughout everything technological, the essence of technology may come to presence in the coming-to-pass of truth. Because the essence of technology is nothing technological, essential reflection upon technology and decisive confrontation with it must happen in a realm that is, on the one hand, akin to the essence of technology, and on the other, fundametally different from it. Such a realm is art." (Heidegger 1978: 316-7)

challenging the whole modern discourse of nature. One can regard Marx's position as a test case for the feasibility of the modern discourse on nature. This is all the more interesting since Marx, in my view, has given the concept "domination of nature" the most compelling formulation. Two things need mentioning here which I take up again later:

1. The concept of domination makes sense for Marx only with respect to interests and needs. Recall the example of King Midas who had the power to turn everything he touched into gold. Now this is clearly a self-defeating power which we would hardly include in a reasonable concept of domination. Likewise, a society which does not take into account the repercussions of its transformation of nature, can hardly be said to dominate nature at all. In this version the usual meaning of "domination of nature" is reversed. In the usual meaning, ecological crises are seen as a result of this very domination of nature. But here they are seen as the absence of domination of nature.

2. Marx links the concept of domination of nature to his communist project: for him communism is a state of affairs in which human beings are capable (for the first time) of full self-realization. All naturally evolved natural and social conditions are the products of their common conscious control. Communism, therefore, is the culmination of a process of increasing mastery over nature.

Alfred Schmidt (1971) maintains that Marx employed a double concept of nature. On the one hand nature was for Marx the totality of all existing "reality", "Gesamtwirklichkeit", comprising human beings and "external" nature (see Schmidt 1971:20,22). On the other hand, nature is only there for human beings if they enter into a practical relationship with it; they are in relation with nature only when transforming it. Marx puts it in the extreme

formula: "But nature too, taken abstractly, for itself, - nature fixed in isolation from man - is nothing for man." (CW 3:345)[62]

But, on the other hand, Marx is aware that man can produce nothing without the help of nature (CW 3:273). In the Critique of the Gotha Programme he stresses that labour alone does not create wealth. Here he insists that nature too produces use-values which are the material precondition for all production. However, the Grundrisse view that only labour can create value (Grundrisse: 366) is not revoked. Against the physiocrats, Marx holds that it is important to analyse the social forms in which value is produced; value - in contrast to wealth - is not immediately given or transhistorical, it is the economic form which material wealth takes under specific conditions (most typically under capitalism). In other words, the above quote from the Grundrisse neither expresses nor implies that Marx disregarded nature in the sense that he undervalued natural preconditions for human production. Quite the contrary is true. However, there is a certain disregard for nature, albeit in a completely different sense. This apparent paradox can be solved in looking at Hegel's distinction between first and second nature.

Hegel distinguished between a first and second nature. As he put it in the Philosophy of Right, para. 4:

> "The basis of right is, in general, mind; its precise place and point of origin is the will. The will is free, so that freedom is both the substance of right and its goal, while the system of right is the realm of freedom[63]

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62 This passage from the Paris Manuscripts indicates that there is no discrepancy between an "ecologist" young Marx and an "economist" later Marx.

63 Compare Marx, Capital 3:820, where he refers to the "realm of freedom", see also chapter 5.

> made actual, the world of mind brought forth out of itself like a second nature. " (Hegel 1953, transl. Knox, my emphasis)[64]

Marx takes this outline as a model for a society in which human beings are no longer dominated by alien powers.[65] As Schmidt rightly comments, Marx disagreed with Hegel on the point of whether existing society, law and state were manifestations of "reason". Marx objected to this Hegelian view for two reasons.

Firstly, he maintained that under given circumstances human beings still experience their own creations as alien powers. In this sense history is still to be characterized as pre-history (1859 Preface). It follows that 2nd nature is still first nature in the sense that it imposes its blind forces on man in a natural way ("blind wirkende Naturgesetze"). It is intriguing to extricate this line of thought from Marx. As Marx indicated in a footnote in Capital 1, he agreed with Vico that man can understand the world which is his own product much better than the world of nature (which is, according to Vico, the product of God)[66]

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64 In the German original: "Der Boden des Rechts ist überhaupt das Geistige und seine nähere Stelle und Ausgangspunkt der Wille, welcher frei ist, so daß die Freiheit seine Substanz und Bestimmung ausmacht und das Rechtssystem das Reich der verwirklichten Freiheit, die Welt des Geistes aus ihm selbst hervorgebracht als eine zweite Natur ist."

65 Fetscher is right when he emphasizes that Marx's point "is that men should be able to consciously control their own form of association (division and combination of labour etc.) instead of being dominated by autonomous structural forces. What the free association of producers has to achieve is the completion of the process of humanization that started with the first conscious transformation of nature by men." (Fetscher 1973:459)

66 As we shall see in chapter 5, Vico's argument needs to be reconsidered.

> Does not the history of the productive organs of man, of organs that are the material basis of all social organization, deserve equal attention? And would not such a history be easier to compile, since, as Vico says, human history differs from natural history in this, that we have made the former, but not the latter? (Capital 1:352)

Let us call the nature before human's transformation $Nature_1$, and the transformed nature $Nature_2$. The latter comprises all products of the human will, all objectifications. We can conceive of culture, history and society as second nature. Now, Marx thought that the more man transforms nature, the more he understands its principles and laws. In this process $nature_1$ becomes $nature_2$. Marx saw the natural sciences as having made great progress in this respect whereas the social realm was still awaiting its revolution. "Revolution" here is to be taken literally, for Marx thought that a social revolution was necessary to establish $nature_2$ properly.[67] To repeat: Hegel maintained that the existing forms of $nature_2$ (law, state, society) were the manifestation of reason; Marx, on the contrary, maintained that, since $nature_2$ acts upon man in a "natural" way , in a way which is not understood ("blind wirkende Naturgesetze"), it cannot be the manifestation of man's reason, but only a distorted version of it.

This leads me to Marx's second objection to Hegel. Marx substituted the notion of "reason" for the notion of man as a "real human being" who has needs, desires and consciousness. He derived this line of thought from Feuerbach's critique of Hegel, as the Paris Manuscripts show (see 2.5.). But what is most important here

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67 After the social revolution, therefore, no social science will be needed any more, see 5.5. and 5.6.

is the implication of this theoretical shift for man's relationship with nature. When I said above that Marx adopts from Hegel his disregard of $nature_1$, this is not to say that his position is condemned as blind to ecological problems. The introduction of the Feuerbachian "real sensuous being"[68]*, as a human living organism, reveals the distinction here. Marx conceives of human beings primarily as 'real bodily entities' (which, of course, also have a brain and "reason") which relate to the rest of nature as their extended body. Marx in his early Paris Manuscripts praises Hegel for having conceived of man as producing himself through labour.[69] This "greatness" of Hegel, however, did not blind Marx to the fact that this Hegelian being was still an essentially spiritual being, a limitation which Marx exposed. But whether we see labour as "spiritual" or "practical", it is not the only source of wealth. In 1875, attacking the Programme of the German Social Democratic Party which declared exactly that "labour is the source of all wealth and of all civilization", Marx wrote:

> Labour is not the source of all wealth. Nature is just as much the source of use values (and it is surely of such that material wealth consists!) as labour, which itself is only the manifestation of a force of nature, human labour power. The above phrase is to be found in all children's primers and is correct in so far as it is implied that labour is performed with the appurtenant subjects and instruments.

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68 As Marx put it in the Paris Manuscripts: "... he is a suffering, conditioned and limited creature, like animals and plants." (cited in Fetscher 1973:451)

69 "The outstanding achievement of Hegel's Phänomenlogie and of its final outcome... is thus first that Hegel conceives the self-creation of man as a process, conceives objectification as loss of the object, as alienation and as transcendence of this alienation, thus grasping the essence of labour and comprehending objective man - true, because real man - as the outcome of man's own labour." (CW 3:332-3, amended translation)

> But a socialist program cannot allow such bourgeois phrases to pass over in silence the conditions that alone give them meaning. (SW 3:17)

In Capital 1 Marx affirms the same: "We see, then, that labour is not the only source of material wealth, of use-values produced by labour." (Capital 1:50)

To conclude, then, Marx's perspective was that only communist society would merge $nature_1$ and $nature_2$, humanizing nature and naturalizing man (to paraphrase a passage from the Paris Manuscripts).[70] In this transformation process two main factors participate: man and nature. Both have physical properties and limits which must be respected if the transformation process is to be continued. So far, the ecologists' attack on Marx is in vain. But they might now argue that Marxism does not take into consideration these parts of nature which are not needed for material production. As I shall show, this claim is not true either. It would be true if consistent ecological politics required a deontological "respect for nature" as a starting point, if an ethical attitude towards nature were the sine qua non for ecological concerns. As we have seen above (2.4.1.), Marx did not attribute an intrinsic, but an instrumental value to nature. However, it is possible to derive an ecological awareness from such a premise if we understand the instrumental value as including other elements (such as aesthetical and recreatio-

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70 Thus he writes in the Grundrisse: "Universally developed individuals ... are no product of nature, but of history." (Grundrisse:162)

nal.)[71] And, what is more, this premise is more likely to help construct criteria for an ecological position which starts from premises of modern reality and tries to develop an ecological critique on the basis of scientific findings.[72]

Still, one might insist that Marx in priviledging second nature, pays too little attention to first nature. It is perhaps helpful to discuss Elster's critique of Marx here. Elster calls Marx's concept of nature "extreme and exaggerated" (1985:56), "exaggerated and pointless" (id.:57). I agree with him when he claims that Marx's concept of nature does not hold true for "the millions of solar systems outside the reach of man." (1985:57) But I think Elster himself underestimates the degree to which nature has been transformed by man. There are two important points which must be made against Elster here. The first is that we usually underestimate the degree to which nature has already been touched and transformed by man. Many landscapes, apart from their geomorphological and topograhical elements, also contain a cultural element in that they have been created by man - they are "landscaped". The most important factor in this process has been the development of

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71 It may also include a cultural and moral element, as the case of cruelty to animals makes clear. But as I have argued in chapter 1, this moral standard is derived from human needs and purposes.

72 Interestingly, much of the current ecological criticism was suggested by critical scientists. The emerging ecological movement took it up but gave it a - partly - anti-modern direction. One important reason for this seems to be that many environmentalists do not trust the present systems to be able to resolve these problems. On the contrary, they seem to believe that further research and further development of technologies would rather worsen the situation than improve it. However, also ecological policy making needs concrete technologies which are economically feasible. Ecosystems-research is of utmost importance here.

agriculture. With agriculture, natural landscapes develop into "cultivated" ones. Bätzing (1984) has shown how this process transformed the Alps. As Passmore put it: "[T]he landscapes we now so greatly admire - the landscapes of Tuscany or of England or of Kyushu - are largely the creation of human enterprise, of human struggles." (Passmore 1974:179)[73] The second point is that this is not only a question of degree, of "how much" nature has been transformed, rather, it is a cognitive point. Elster seems not to be aware of the crucial importance of this point for Marx's whole project; for if this point is wrong, his whole project fails. It is therefore not sufficient to call his view "extreme and pointless" (Elster 1985:57). If Marx is wrong in his exaggerated view, his whole project fails, because this view is one of the cornerstones of a true, human society: from this view derives Marx's optimism, together with the belief that a rational society (human society, communist society) presupposes the human understanding of the processes at work (in nature and society.) Admittedly, Elster himself associates this Marxian viewpoint to Marx's theory of the good society (cf. ibidem), without paying more attention to its cognitive implications. The more human beings have transformed $nature_1$ into $nature_2$ - so goes Marx's claim - the more they are able to understand the world, the more they are able to avoid "enslaving effects" which stem from natural or social processes. We must not forget that Marx saw his project as the continuation of a critique of religion; his concern was to abolish man's (unfounded) beliefs in natural or mystical powers. Taken in this sense, even the solar systems (at least those within the reach of telescopes) have been "transformed" by man even

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73 See also Marx on Feuerbach: "[T]he nature that preceded human history is not by any means the nature in which Feuerbach lives, it is nature which today no longer exists anywhere (except perhaps on a few Australian coral islands of recent origin) ... (CW 5:40))

without putting hand on them; their movements are understood. It was no accident that the phrase of "copernican revolution" was coined for its new conception of man's position in the cosmos. Similarly, it could be argued that we now know what oxygen is, i.e. we know its 'secrets'. In this sense it is transformed, since it represents something other to man than it did before.[74] These remarks should have made clear that Marx's contention is necessary for his theory and that it does indeed make sense.

2.5. Philosophical anthropology

As Schmidt (1971) has shown, Marx, analysing the man-nature relation, followed a methodological approach which was substantially the same throughout his writings. Its first element is, as we have seen, the double characterization of man as both natural and social being, a definition in which we can detect Feuerbach's influence (man is both "Natur-Mensch" and "Menschen- Mensch").[75]

2.5.1. Man as both a natural and social being

The 'natural' and social dimension are intertwined. When Marx uses the metaphor of nature as man's inorganic body, and refers to this relation as Stoffwechsel, the natural dimension is obvious: man as part of nature acts upon nature, just like any other natural element may have an impact on another. In this respect, man is

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74 Note that I remain on a "realist" epistemological level which is sufficient to understand how Marx discussed the achievements of the natural sciences. All attempts to impute a Kuhnian notion of science to Marx are beside the point. See also Cohen (1978).

75 See Feuerbach (1959, 1960, 1973).

a biological being with physical needs; a being who, like all other living beings, can only exist within a natural environment. Marx expressed this view in his early Paris Manuscripts with the metaphor of nature being man's "inorganic body"; in Capital he used the language of "metabolism", or "interchange with nature" (as the German "Stoffwechsel" is rendered in English). But this Stoffwechsel takes place in community with others. Thus human beings are also social beings. As Marx states in the Introduction to the Grundrisse:

> The human being is in the most literal sense, a zoon politikon, not merely a gregarious animal, but an animal which can individuate itself only in the midst of society. Production by an isolated individual outside society - a rare exception which may well occur when a civilised person in whom the social forces are already dynamically present, is cast by accident into the wilderness - is as much an absurdity as is the development of language without individuals living together and talking to each other. (Grundrisse:84)

Marx stresses this double relation of man to his fellowmen and to nature throughout his work. As a result of both their natural (brain) and social character (common goals, tradition of know-how, skills) human beings are able to harness nature, to make it work for them. As Marx remarks in the Grundrisse:

> Nature becomes purely an object for humankind, purely a matter of utility; ceases to be recognised as a power for itself; and the theoretical discovery of its autonomous laws appears merely as the ruse to subjugate it under human needs, whether as an object of consumption or a means of production. (Grundrisse:410, amended translation)

And in Capital 1:

> An instrument of labour is a thing, or a complex of things, which the labourer interposes between himself and the subject of his labour,

> and which serves as the conductor of his activity. He makes use of the mechanical, physical, and chemical properties of some substances in order to make other substances subservient to his aims. (Capital 1:174-5)

In a footnote to this passage Marx refers to Hegel, whom he cites approvingly:

> Reason is just as cunning as she is powerful. Her cunning consists principally in her mediating activity, which, by causing objects to act and re-act on each other in accordance with their own nature, in this way, without any interference in the process, carries out reason's intentions. (Cited in ibidem; German original in Hegel 1970a:365)[76]

The main feature of men thus is not so much that they are tool-making[77] but that they are "intelligent" in that they can anticipate outcomes of their action upon nature. Human beings are able to project outcomes of natural processes and outcomes of their own work. To illustrate this, Marx compared human activity with that of a spider and a bee:

> A spider conducts operations that resemble those of a weaver, and a bee puts to shame many an architect in the construction of her cells. But what distinguishes the worst

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76 In his Naturphilosophie Hegel makes a more elaborate statement: "Das praktische Verhalten zur Natur ist durch die Begierde, welche selbstsüchtig ist, überhaupt bestimmt; das Bedürfnis geht darauf, die Natur zu unserem Nutzen zu verwenden, sie abzureiben, aufzureiben, kurz, sie zu vernichten... Die Not und der Witz des Menschen hat unendlich mannigfaltige Weisen der Verwendung und Bemeisterung der Natur erfunden... und zwar nimmt er ... Mittel aus ihr [und] gebraucht sie gegen sie selbst; und die List seiner Vernunft gewährt, daß er gegen die natürlichen Mächte andere natürliche Dinge vorschiebt, diese jenen zum Angreifen gibt und sich dahinter bewährt und erhält." (Hegel 1970b:13 f.)

77 See Elster (1985) for a distinction between tool-making and tool-using

> architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality. (Capital 1:174)

This projective consciousness is the decisive difference between human beings and animals. Human beings can decide how to build their houses. They do not have a 'natural' place in the ecosystem but they are able to adapt to many environments. Again, as distinct from animals, men do not change their species character in this process of adaptation, but on the contrary, they exercise it.[78] Human beings have been described as "Mängelwesen" (Gehlen), beings of shortcomings and deficiencies. "But", as Fetscher rightly comments, "man's biological disadvantage is at the same time the basis for his superiority over animals." (Fetscher 1973: 444) Hence Marx's definition fits well with the definition in 1.2. where the relation between man and nature was defined as: man being (1) in and (2) against (dominating) nature.

2.5.2. Human needs

A decisive feature of man is that he produces and develops his productive capacities. But where does this drive come from? Marx's answer is simple: from human needs. We can derive two sorts of human needs according to my distinction between natural and social characteristics of human beings. As Elster put it:

> "The concept of human needs is fundamental in Marx's theory of human nature. The good society, for Marx, is one in which people are

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78 Strictly speaking the notion of species-essence is not compatible with the Darwinian notion of species. The latter's main characteristic is in fact that it changes, cf. Gellner (1987:50) In fact, as we shall see later when discussing evolutionary models, it does not make very much sense to take "mankind" or "society" as species in the Darwinian sense.

> rich in needs and rich in need satisfaction. Conversely, capitalism is defective both because people have few needs and because the needs they do have are not satisfied." (Elster 1985:68)

The concept of needs is important also in another sense. We saw that the notion of domination (in general, and in respect to nature) is meaningful only if linked to a notion of interests.[79] Now, how can we establish this link? Elster, drawing on Heller (1976), constructed the following typology of needs in Marx. It includes

(1) Physical needs which are needs for physical or biological necessities;
(2) Necessary needs which correspond to the conventional and accepted standards of living of a particular group of people at a particular time and place;
(3) Luxury needs are needs which exceed (2);
(4) Social needs are needs which (i) are social in origin, (ii) are social in content or (iii) can be satisfied only communally (cf. Elster 1985:69).

Obviously, each point in this typology can be related to the ecological problematic in one way or another. To be more specific, I shall qualify the relations in the following way.

(1) Physical needs: it is immediately clear that a debased environment may not permit of need satisfaction. This is the case for inhabitants of an extremely polluted area who can no longer have these needs (like food) satisfied in that area;

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79 For reasons of simplicity I take the two as synonymous here. See, however, the treatent in Heller (1976).

(2) Necessary needs: standard goods of consumption (like water) which have such a low price (if any) that it can be neglected when calculating standard of living, may increase in their prices because it becomes more and more costly to keep water, for example, clean. As a result, the historical and moral elements which enter this category, will change;
(3) Luxury goods: it is a cultural and political question to define the distinguishing line between (2) and (3). Some orthodox Marxists and some committed "workerists" have contended that the perception of environmental problems, as it occurred in the early 1970s, was an expression of the privileged status of the middle and upper classes. Workers, on the contrary (so went the claim), have always faced these problems at their workplaces and tried to improve their situation. In some extreme versions of this "workerism", it is claimed that workers should not bother about these problems but instead pursue their "real" class interests;
(4) Social needs: Elster gave an example for a social need which can be satisfied only communally: the need for education. Education can be seen as a public good which is usually provided by the state. By analogy, we can apply the logic of collective goods to many ecological problems. Clean air and clean water may serve as examples here. All environmental problems are social in origin in that they are produced socially; to overcome them is both a social concern and a social need.

2.5.3. Human nature essential to Marx

To define human beings as communal and creative[80] justifies coining the term theory of human nature. Man as a "toolmaking

80 For obvious reasons, I take "creative" here to mean both constructive and destructive. In any case, what counts as constructive or destructive, is observer-dependent.

animal" can be seen as part of the creative dimension. As Norman Geras, in a most detailled and convincing study, has shown, throughout his writings Marx adhered to something we could describe as "human nature". To support this claim, he makes over a hundred references to Marx's works. Let me repeat some of them.

In the Holy Family of 1844, Marx accuses Bruno Bauer of sublimating "all that affirms a finite material existence outside self-consciousness. What he combats ... is ... nature; nature both as it exists outside man and as man's nature." (CW 4: 141)

In the German Ideology of 1845, Marx criticises Christianity: "The only reason why Christianity wanted to free us from the domination of the flesh and 'desires as a driving force' was because it regarded our flesh, our desires, as something foreign to us; it wanted to free us from determination by nature only because it regarded our own nature as not belonging to us." (CW 5: 62)

In the Grundrisse of 1857, he speaks of wealth, stripped of its bourgeois form, as the "full development of human mastery over the forces of nature, those of so-called nature as well as of humanity's own nature". And he links this to "the absolute working-out of [man's] creative potentialities", which "makes this totality of development, i.e. the development of all human powers, as such, the end in itself." (Grundrisse:488)[81]

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81 Cf. also the following passage: "The basis as the possibility of the universal development of the individual, and the real development of the individuals from this basis as a constant suspension of its barrier... Not an ideal or imagined universality of the individual, but the universality of his real and ideal relations." (Grundrisse:542)

In Capital 1 he polemicizes against Bentham and his principle of utility, and concludes: "... he that would judge all human acts, movements, relations, etc. according to the principle of utility would first have to deal with human nature in general, and then with human nature as historically modified in each epoch. Bentham does not trouble himself with this. With the driest naiveté, he assumes that the modern petty bourgeois, especially the English petty bourgeois, is the normal man." (Capital 1:571)

Finally, in Capital 3 Marx, distinguishing the realm of freedom from that of necessity, writes: "Freedom in this field [the field of material production, R.G.] can only consist in socialized man, the associated producers, rationally regulating their interchange with nature, bringing it under their common control instead of being ruled by it as by the blind forces of nature; and achieving this with the least expenditure of energy and under conditions most favourable to, and worthy of, their human nature." (Capital 3:820)

The evidence that Marx holds a specific view of human nature seems clear and abundant. And yet, one interpretation of Marx, namely the one of Althusser and his followers, has denied precisely this. What is taken as evidence that there was no 'humanistic' element in Marx is the sixth Thesis on Feuerbach, the second and third sentences of which read as follows: "But the essence of man is no abstraction inherent in each single individual. In its reality it is the ensemble of the social relations." (CW 5:4) As regards the exegetical level, Geras shows that the 6th thesis can by no means be taken as support for the 'anti-humanist' interpretation of Marx (see Geras 1983a: 27-87). With regard to the substantial level, I would like to add the following. When Marx speaks of human nature, and in the sixth thesis apparently denies such human essence, this should be explained in the following way. What the human essence is, can

only be grasped from its emanations, from its objectifications. This combines the Hegelian idea (that the real is the rational) with the "positivist" idea that only real, observable entitities form the object of scientific investigation. Marx, most explicitly in the German Ideology, conceives of human characteristics such as creativity and communality as empirically-given facts which can be observed and analysed. Modern Industry is a product of this "inner essence", a thought which already appeared in the Paris Manuscripts. There might be many other human traits which have manifested or which will manifest themselves; what Marx is interested in is the significance of these traits. How does he define what is significant and what is not? According to him, the (self-) production of the conditions of human life is the most significant character of humans, which leads him to attribute to the development of the productive forces, and the relations of production, a prominent place. Certainly, Marx is equally aware of the importance of language or power but he attributes only a secondary role to them. This is because he takes pains to avoid what we may call "Don Quixotism", i.e. the attempt to bring about something for which the preconditions are missing. Such attempts sometimes look funny, sometimes dreadful, and Marx scorned many of his contemporaries for this reason (most notably the Utopian Socialists). Consider how Marx relates class-struggle (power) to the development of the productive forces. According to him, class struggle can only play the role of a midwife, a metaphor which Marx used several times. The analogy is obvious: as in biology, in social life, the objective preconditions must be given in order that a midwife can take up her job. This takes me to another set of arguments.

Up to now we have listed a number of statements on human nature which are explanatory in character. Additionally, Marx employs the concept in a normative sense. He not only holds that there exists something like a human nature, but, moreover, he qualifies this.

The substantial part of his concept of human nature is contained in his notion of labour as free, creative activity. In the Paris Manuscripts he distinguishes men from animals by defining their species character:

> Free conscious activity is man's species character... The animal is immediately identical with its life-activity... Man makes his life-activity itself the object of his will and consciousness... Conscious life-activity directly distinguishes man from animal life-activity...Admittedly animals also produce. They build themselves nests, dwellings... But man in the working up of the objective world... duplicates himself not only, as in consciousness, intellectually but also actively, in reality, and therefore he contemplates himself in a world he has created. (CW 3: 275-7)

But human beings are not only creative, but also communal, even in cases where they are not directly cooperating, in actions like composing, writing, thinking. "The individual is the social being. His manifestations of life - even if they may not appear in the direct form of communal manifestations of life carried out in association with others - are therefore an expression and confirmation of social life." (CW 3:299)

Marx saw clearly that the present conditions of production (capitalist relations) impinge upon the full realization of these human characteristics. The abolition of these conditions would thus give rise to the realization of all human powers.

This "expressivist" notion of labour (Ch. Taylor 1975) is present in all stages of Marx's theoretical development.[82] Just

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82 Marx's normative level has been discussed under the label of "humanism". For the normative dimension of the younger Marx there already exists a vast literature, cf. von Magnis (1975). That a normative dimension is also present in the

as German Idealism saw the formation of spirit as self-consciousness, Marx as a materialist "praxis-philosopher" sees the formation of human species as self-creation: externalisation, objectification and appropriation are the three aspects of this circle.[83] In this context, we have the human labour on one side and the objectified, dead labour on the other. The latter is the crystallized result of man's interchange with nature. 'Dead labour', therefore, is many things: technology, buildings, but also culture, institutions; it is man's second nature.

My insistence on 'human nature' in Marx may be anomalous to many Marxists.[84] As G.A. Cohen has correctly pointed out, "[i]t is a

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work of the late Marx could even be accepted by the "anti-humanist" interpretation; but it cannot accept the claim that this humanist dimension is basic to Marx's criticism.

83 Habermas (1985:80). There are a number of scholars who interpret Marx as transposing Hegel's model to his anthropocentric approach, substituting "Spirit" with "mankind". Cf. Kolakowski (1978), Habermas (1980), Theunissen (1978), Benhabib (1987). They all point out that Marx also inherits the fundamental difficulties of that theoretical model. In my view, the heritage of subject philosophy must be regarded as part of the normative orientation of Marx, of his insistence that the subject will be able to reappropriate its own creations. Since there is no theoretical proof for this outline, we shall see later at which conclusions we arrive on the basis of a more sober argumentation (chapter 5).

84 See, for example, Alfred Schmidt who claims that Marx, regarding human nature, does not know any fixed facts, be they of an intellectual or a biological nature. (1971:42) Schmidt is an exceptional case of an ambivalent position in this respect. Belonging to the 'humanist' tradition in Marxism ("Frankfurt School"), he nonetheless denies a theory of human nature in Marx. He shares the Althusserian argument that Marx, above all in the sixth Thesis on Feuerbach, turned away from the concept of Gattungswesen, human essence etc. But Schmidt has difficulties explaining why Marx in

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marxist tradition to deny that there exists an historical invariant human nature. The point is made against conservatives who fix on some historically virulent behaviour pattern (usually an unpleasant one), assign it to human nature, and conclude that the pattern will appear in every society, or be eliminated only by extreme tyranny." (Cohen 1978:151) But this marxist tradition is mistaken, for "it is not necessary to claim, in response [to the conservatives'], that there are no quite permanent facts of human nature. All that need be denied is that the particular feature the conservative emphasizes is one of them." (ibidem)

To summarize: Marx held the view that there are enduring facts of human nature. These enduring facts contain a biological-physical and social element. The biological element is that man is a mammal with a definite biological constitution. Part of this constitution is an excellent brain which enables him to 'step outside of nature' to a certain degree. This 'stepping out' consists in the ability to develop and use technologies in order to transform nature. Unlike other animals, human beings not only use their organs in order to relate to nature, but they also use instruments, artificial organs and natural processes to transform nature. In this sense, man can be described as a 'toolmaking animal'.

Turning to the social element, the decisive features which need mentioning are the creative and communal elements. Men are creative in that they project and produce new and contingent (i.e. not pre-determined by nature) things. In so doing they also

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Capital again endorses the notion of 'man'. See Schmidt (1973:21 fn31; 25 fn42). It seems that he confuses the concept of human nature with a static view about human needs, see Schmidt (1971:82 ff.).

develop a theoretical relation to nature, as expressed, for example, in science. They are communal in that they always organize their life together with others. They cooperate and develop a language. To both elements corresponds a specific consciousness. In the first case, it is a projective consciousness: man anticipates in his brain the outcome of his activity. In the second case, the consciousness is a social consciousness: man shares the outcome of the several activities and reflects with others upon them.

These three features taken together make culture and history. There may be animals which display some of these features to a certain degree, but they certainly do not possess all of them in the full sense. A further argument for human nature is as follows. Human nature also means that human beings' well-being depends on their engaging in activities of these three kinds. If they are prevented from doing so they (generally) do not feel well. In this case they are (generally) in a pathological state of existence. Human beings need the 'working out' of their abilities and potentialities, the reflection on the result of these activities, the communication with others and the imagination of other possible worlds.

2.5.4. Criticisms

In what follows, I present three criticisms of Marx's human nature theory which focus on different parts of that theory. Elster questions a factual claim whereas Fetscher and Cohen are sceptical about what they see as some of its normative implications.

a. Elster's criticism

I start with a critique of Marx's concept of human nature which has been put forward by Jon Elster. He doubts Marx's criteria for

distinguishing men from animals. Both as regards tools and projective consciousness, Elster believes that some animals display the same features as men; it follows that Marx's account is not in accordance with recent biological research. I think that Elster's criticism rests on a misunderstanding. He does not evaluate the importance of the social dimension to human nature. By this Marx not only means that men interact with each other but also that they share knowledge and skills with other generations before and after them (virtually with the whole of mankind). It is only by giving a distorted view of the social dimension (is this the pitfall of methodological individualism?) that Elster can suggest a behaviour of certain animals which is essentially similar to that of men. That animals, too, are tool-using or even "labouring" does not invalidate Marx's claim. To repeat: human beings pass on their technology, knowledge, skills to future generations, and they also acquire them from former generations. In the course of the history of mankind we thus observe an accumulation of tools, skills and knowledge. The social dimension of Marx's human nature theory is thus not confined to an empirically-given set of individuals. Only if Elster could show that animals, too, learn from former generations and remember what has been known hundreds of years ago, can decipher relics of former epochs, would his point present a strong objection to Marx's claim. As shall become clear later, the specific human action upon nature results in an acceleration of social evolution which at the same time makes a difference to the animal world.

b. Fetscher's criticism

Fetscher interprets Marx as employing two views of man. One is the definition in Capital, where Marx defines man with Franklin as a toolmaking animal. For Fetscher, this "truncated view of man" is "the source of most errors in traditional socialism..." (Fetscher 1980:56) However, so the claim goes, in his early works Marx did

not reduce man to a toolmaking animal, "rather he understood him as a subject who realizes his own essence through the objectivation of his activities." (Fetscher 1980:56) But, in so doing, Fetscher claims that Marx idealizes man and burdens him with exorbitant demands. Fetscher, similarly to Cohen, argues that Marxists should take the emotional needs of men more seriously; they should take account of their need for self-consciousness and self-assurance. He further points out:

> In this respect it is not sufficient that each world citizen or world comrade is recognized as such by all others; for such recognition, which can be imagined only in the abstract, would not yield emotional satisfaction. People need recognition by their immediate peers and neighbors. This confirming recognition (emphatically also called love) can neither be ordered nor introduced through intellectual arguments. It blooms only on the basis of an upbringing that strengthens the ego and avoids repression. Many Marxists, however, hold on to the illusion that the establishment of societal property would automatically result in the emergence of a new man. (Fetscher 1980:58)

And:

> certain emotions such as jealousy, hate, distrust may disappear when those orders disappear, though this may take a long time. Other emotions, which result from man's biological nature, from his helplessness as a small child, from his being thrown into the world, will continue to belong to man's make-up. (Fetscher 1980:57)

I think this criticism points to an important problem in Marx's thought which has to do with his over-emphasis on capitalist relations as the main evil. But is not true that Marx reduces man to a "toolmaking animal", as I have shown above. Moreover, the emotional satisfaction which Fetscher stresses is contained in Marx's theory of human nature: humans recognize themselves in

their products.[85] Finally, the fact that man is thrown into the world is recognised by Marx in the 18. Brumaire of Louis Bonaparte where he says that men make their history but "they do not make it under circumstances chosen by themselves. Instead, they make it under circumstances directly encountered, given, and transmitted from the past." (CW 11:103). This holds true even for communist society: in communism, too, for example, each child will be in need of socialisation. The point is that communism will have reduced to a minimum the difficulties for a new generation.

But there is indeed a point which probably does not fit into Marx's theory of human nature. This is his normative claim that egoism is a product of bourgeois society. In the Paris Manuscripts he criticises the one-sided anthropology of Political Economists who see only greed as the driving force in society (cf. CW 3:271) But it would be equally wrong to assume universal altruism - a mistake which Marx never made. Marx seemed to assume that a division of labour will be possible under communism which distributes and combines the different needs and interests of the individuals and groups of individuals to the overall and individual benefit. I return in chapter 5 to this topic.

c. Cohen's criticism

G.A. Cohen questions both the possibility and the desirability of Marx's "total individuals". Starting from a comparison between Hegel and Marx he charges Marx with having abandoned a most valuable element of Hegel: humans' need for self-definition, for

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85 However, this may be a problematical, if not unrealistic, assumption. As Elster pointed out, people in communism would compete to deliver to society as much as they can since they would enjoy both this activity and the benefit they would have from the contributions of others. Elster calls this the model of a "scholarly community" and pleas for it to be abandoned.

identity. From this basic flaw follows Marx's blindness with respect to national, racial or religious conflicts which "generate, or at least sustain, ethnic and other bonds whose strength Marxists systematically undervalue, because they neglect the need for self identity underlying them." (Cohen 1983:235) This undervaluation of self-definition can also be located in Marx's ideal of work as the release of all powers inherent in man, thus escaping location within a social role. As Marx said in the German Ideology: "In a communist society there are no painters but at most people who engage in painting among other activities." (CW 5: 394) Cohen comments: "A society in which everyone is free to develop in any direction is not the same as a society in which anyone is able to develop in every direction: that kind of society will never be, because there will never be people with that order of ability." (Cohen 1983:237)[86]. Cohen overlooks that Marx holds social functions to be indispensable to communist society, both in the early German Ideology and the later Critique of the Gotha Program (see CW 5:47 and SW 3:26). Thus, when Marx speaks of the "development of all human powers", the "absolute working out of his creative potentialities" (Grundrisse:488), he does not deny that individuals adapt to certain roles for a certain period in their life, and he does not say that each and every individual will be able to work out all of his creative potentialities, nor that he should. Marx's main concern was to explore the possibilities for an abolition of the fragmenting effects of the division of labour; he consequently advocates the free development of individualities which is the condition for abolishing the "correlation" between social functions and technical roles on the one

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86 Or, in Selucky's words: "One can hardly invent computers in the morning, perform neurosurgery in the afternoon, repair a jet in the evening and conduct a symphonic orchestra after dinner without becoming respectively computer engineer, neurosurgeon, jet-mechanic and conductor." (1979:10-1) But everyone can, according to Andy Warhol, become famous for 15 minutes in his life.

hand and class positions on the other. As Fetscher noted, Marx in his mature works "no longer pretends that the division of labour will altogether disappear. Certainly there will be different social functions and people to fill them..." (Fetscher 1973:461). And on the other hand, so Fetscher continues, "the very nature of modern industrial production and the rapid change of its technology will demand many more many-sided individuals." (id.) Marx thought that the development of modern industry and the development of human needs and capacities would go together. This connection is established in the German Ideology: "[P]rivate property can be abolished only on condition of an all-round development of individuals, precisely because the existing form of intercourse and their existing productive forces are all-embracing and only individuals that are developing in an all-round fashion can appropriate them i.e. can turn them into free manifestations of their lives" (CW 5:439; see also CW 5:86ff.). In Capital 1, Marx similarly points out that "modern industry through its catastrophes imposes the necessity of recognizing, as a fundamental law of production, variation of work, consequently fitness of the labourer for varied work, consequently the greatest possible development of his varied aptitudes." (Capital 1:458). Marx employs a functional explanation in the sense that human abilities have to adapt to productive necessities. This argument, however, presupposes a gap between the development of productive forces and individual abilities. Thus, Marx tacitly assumes that mankind's collective objectifications (such as technology) evolve at a different speed or rhythm from individual capacities; since both are tied together by functional requirements (a technology which cannot be mastered will disappear or lead to catastrophes), they co-evolve. This leads Marx to the enigmatic statement that mankind sets itself only tasks which it is able to fulfil (1859 Preface).

CHAPTER 3: TECHNOLOGY

> It is not the articles made, but how they are made, and by what instruments, that enable us to distinguish different economic epochs.
>
> Karl Marx

So far I have discussed the concept of nature and human nature in Marx and some implications for the ecological problematic. Now I turn to the topic of technology. Apart from the importance this subject has for my discussion of Marx, it additionally provides the opportunity to investigate a subject which has been largely neglected by political and social theory as well as by philosophy.

For the sake of conceptual clarity, the following remarks are in order. The English notion "technology" is equivalent to the German "Technik" which derives from Greek "techné" and means intentional, goal-directed change of things. The International Encyclopedia of the Social Sciences gives a useful definition:

> [In] its broad meaning it connotes the practical arts. These arts range from hunting, fishing, gathering, agriculture, animal husbandry, and mining through manufacturing, construction, transportation, provision of food, power, heat, light, etc., to means of communication, medicine and military technology. Technologies are bodies of skills, knowledge, and procedures for making, using, and doing useful things." (Merrill 1968:576)

In order to identify these "useful things" more precisely, Merrill adds that the concept of technology "centers on processes that are primarily biological and physical rather than on psychological or

social processes." (ibidem:577) Note that with this narrow definition of technology not just any means-ends relationship counts as technology; rather, it stresses means-ends relationships which take place on a "material" level. It is easy to see how the narrow definition of technology corresponds to Marx's concept of technology which also stresses the material aspect.[87]

In 3.1. I shall discuss Marx's approach to Modern Industry.[88] Here, I am especially interested in his definition of machinery and his evolutionary view of technology. Several contemporary attempts at conceiving technology in an evolutionary way will be discussed in 3.2. Closely connected to this problem is the problem of distinguishing between science and technology. I then discuss two theoretical possibilities which are contained in Marx's general position. The first is technological determinism which I address in 3.3.; the second is technological alienation which I address in 3.5. Closely connected to the question of technological determinism and to an evolutionary view of technology is the question whether technology can be conceived as having an "inner logic" or "autonomy". I shall address this problem in 3.2. and 3.4., discussing some contemporary approaches. 3.6. will discuss the concept of division of labour in Marx.

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87 For two usages of a wide notion of technology, see Weber (1967:32f.) and Heidegger, who stresses that techné is not only the name "for the activities and skills of the craftsman, but also for the arts and for the fine arts." (Heidegger 1978:294).

88 The German Große Industrie has been translated as "Modern Industry" as well as "Large Scale Industry". I shall use the former since the text which was at my disposal adopted this translation. The decisive differences between the epoch of Große Industrie and other epochs (such as manufacture) are what are important.

It has been claimed by several authors that Marx employs a theoretical model which conceives the results of human action as becoming independent from their producers (a process called objectification) but eventually reappropriated. In cases where this reappropriation is not possible but where the objectifications are retroacting upon the producers in a detrimental way, we have a state of alienation.[89] If such a "lack of control" can be discerned in the working of technology, if modern technology operates behind the backs of the individuals, then we would have an exact parallel on the technological level to what Marx analyzed regarding economics.[90] Moreover, as can be shown, Marx himself sometimes suggested such a parallel but did not subsequently develop it. That he could not adhere to such a position will be made clear as well: if there was something in the human condition (technology) which escaped successful social control, his project of liberating society from "alien powers" would have failed.

3.1. MARX AS A STUDENT OF TECHNOLOGY

As Rosenberg (1982a) emphasized, Marx was a careful student of technology. He argues that

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89 See Plemenatz (1975) and Elster (1985) for a distinction between spiritual and social alienation.

90 Schelsky spoke of a "neue Selbstentfremdung des Menschen, die mit der wissenschaftlichen Zivilisation in die Welt getreten ist. Die Gefahr, daß der Schöpfer sich in sein Werk, der Konstrukteur in seine Konstruktion verliert, ist jetzt die metaphysische Versuchung des Menschen. Der Mensch schaudert davor zurück, sich restlos in die selbstproduzierte Objektivität, in ein konstruiertes Sein, zu transferieren, und arbeitet doch unaufhörlich am Fortgang dieses Prozesses der wissenschaftlich-technischen Selbstobjektivierung." (Schelsky 1965, cited in Habermas 1973:172)

> "quite independently of whether Marx was right or wrong in his characterization of the future course of technological change and its social and economic ramifications, his formulation of the problem still deserves to be a starting point for any serious investigation of technology and its ramifications." (Rosenberg 1982a:34)[91]

According to Rosenberg, Marx "devoted much time and effort to explicating the distinctive characteristics of technologies, and to attempting to unravel and examine the inner logic of individual technologies." (Rosenberg 1982a:34) Furthermore, "he insisted that technologies constitute an interesting subject, not only to technologists but to students of society and social pathology as well, and he was very explicit in the introduction of technological variables into his arguments." (1982a:34)

But why was Marx so obsessed by the feature of technology to the extent that he focused on it in all his major theoretical works? I think that any answer has to consider at least two elements. First, Marx sees technology as part of the human condition, as the means by which man exercises and regulates his Stoffwechsel with nature. Second, Marx was aware of the importance of the productive forces for the development of a mode of production, for the evolution of relations of production, and, specifically, he was interested in the role of machines and machinery for the emergence of capitalism; likewise, he was interested in the technological basis of communist society. In what follows, I shall turn to each of the two topics.

3.1.1. Technology as part of the human condition

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91 The history of technology is indeed a very young dicipline. See Hughes (1979) for an overview of emerging themes in this discipline.

As early as in the Paris Manuscripts he states that modern industry reveals man's active relationship with nature.

> We see how the history of industry and the established objective existence of industry are the open book of man's essential powers, the perceptibly existing human psychology. (CW 3:302)

Of course, there has been an original state in which "the free gifts of nature [were] abundant" (Grundrisse:612) and hence there was no need to develop technologies. This state is, according to Marx, a pre-historical one. As soon as human beings develop technologies they begin to have a history. Thus we are able to reconstruct main characteristics of earlier societies by examining the different ways in which production took place. As Marx states:

> Relics of bygone instruments of labour possess the same importance for the investigation of extinct economical forms of society as do fossil bones for the determination of extinct species of animals. It is not the articles made, but how they are made, and by what instruments, that enables us to distinguish different economical epochs. Instruments of labour not only supply a standard of the degree of development to which human labour has attained, but they are also indicators of the social conditions under which that labour is carried on. (Capital 1:175-6)

In the Poverty of Philosophy, Marx is already familiar with the works of Babbage and Ure who analyzed technology and, particularly, machinery:

> The machine is a uniting of the instruments of labour, and by no means a combination of different operations for the worker himself... Simple tools; accumulation of tools; composite tools; setting in motion of a composite tool by a single hand engine, by man; setting in motion of these instruments by natural forces; machines; system of machines having one motor; system of machines having an automatic motor - this is the progress of machinery. (CW 6:186-7)

The interesting question now is whether these evolutionary stages of technology are to be explained from within their own development or if they are determined by outside factors. Rosenberg suggested that Marx assumed an "inner logic" of technology (Rosenberg 1982a:34) whilst simultaneously rejecting any technological determinism in Marx. This section will focus on the problem.

In Capital, Marx explicates the concept of Stoffwechel in the following way:

> Technology discloses man's mode of dealing with nature, the process of production by which he sustains his life, and thereby also lays bare the mode of formation of his social relations, and of the mental conceptions that flow from them. (Capital 1:352)
>
> But just as man requires lungs to breathe with, so he requires something that is work of man's hand, in order to consume physical forces productively. (Capital 1:365)

If we recall Fig. 2, it follows that in Marx's conception all three factors involved in this Stoffwechsel process are changing: human beings, technology and nature. Furthermore, Marx aims at an identification of a 'driving force', a mechanism which sets the change in motion.

My claim is that Marx approaches this problem in two different ways. One way is to examine history and to draw conclusions. This is essentially an explanatory task. The other way is to evaluate the development of the three factors; this is essentially a normative enterprise. In order to distinguish these two aspects, I use the terms "historical" and "critical".

Taking the historical approach to the problem we can conclude that Marx conceived in principle all three factors as 'driving force':

(a) nature: geographical determinism[92]
(b) technology: autonomous development, inner logic, evolution
(c) human beings: their needs, developing technologies, transforming nature.[93]
Thus the circle can be started from all three points.[94]

Turning to the critical dimension, Marx's theoretical humanism immediately springs to the mind. Because the good society for Marx is a society in which no alien powers exercise any 'enslaving effects' on the individuals, but, quite the contrary, in which individuals are fully developed and autonomous, an autonomy of (a)

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92 We find an instance of geographical determinism in a passage (crossed out by Marx) from the German Ideology: "These conditions [geological, oro-hydrographical, climatic; R.G.] determine not only the original, spontaneous organisation of men, especially racial differences, but also the entire further development, or lack of development, of men up to the present time." (CW 5:31) See also Manuscripts 1861-3 where he states that geographical and climatic factors determine the differences in the natural tools ("in den natürlich vorgefundenen Arbeitsinstrumenten") which in turn divide the branches of existence of different tribes (Cf. MEGA II.3.1.:266-7).

93 Boserup (1981) makes an argument that population and technology stimulate each other through history. Since the ratio man-land is a decreasing one, human beings develop more productive technologies in order to maintain (or improve) their situation. Note that Marx also sees the possibility that population growth can be a productive force, see Grundrisse:400; 528-9; 749.

94 The determining role of nature may be limited to an original state where production and society start "from scratch". (see last footnote). For industrially-developed societies we could thus neglect the point. Ironically, however, it comes in again through the back door, when "careless" use of technology and natural resources has led to a debasement of the natural environment, which in turn affects human well-being and requires measures (often new technologies) to improve the situation.

or (b) could cause difficulties for his theory. In his view, a society cannot be called free as long as enslaving effects are exercised, no matter if they come from nature or technology. If technologies are detrimental for the human well-being, they must not enjoy autonomy in his theoretical framework. With respect to nature Marx in the German Ideology clearly states that a society which lives in an untransformed nature can only be called "borniert": "Hier wie überall tritt die Identität von Natur und Mensch auch so hervor, daß das bornierte Verhalten der Menschen zur Natur ihr borniertes Verhalten zueinander, und ihr borniertes Verhalten zueinander ihr borniertes Verhalten zur Natur bedingt, eben weil die Natur noch kaum geschichtlich modifiziert ist..." (MEW 3:31; cf. CW 5:44)[95]. With respect to technology Marx makes clear that labour must reappropriate the objectified productive forces "not only to achieve self-activity, but ... to safeguard their very existence":

> "[Th]e productive forces appear as a world for themselves, quite independent of and divorced from the individuals, alongside the individuals; the reason for this is that the individuals, whose forces they are, exist split up and in opposition to one another, whilst, on the other hand, these forces are only real forces in the intercourse and association of these individuals. Thus, [...] we have a totality of productive forces, which have, as it were, taken on a material form and are for the individuals themselves no longer the forces of the individuals but of private property, and hence of the individuals only in so far as they are owners of private property. Never, in any earlier period, have the productive forces taken on a form so indifferent to the intercourse of individuals as individuals, because their intercourse itself was still a restricted one." (CW 5:86-7)

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95 I quote from the German original here since the English translation loses some of the meaning.

The only instance which legitimately enjoys autonomy is the fully developed individual. True, Marx always acknowledges the eternal condition of mankind to produce and reproduce itself within natural limits ("realm of necessity"). Exactly because such limits do exist, so he concludes, the realm of necessity will never vanish completely (cf. Capital 3:820). But he thinks that alienation also in the field of necessity (i.e. transformation of nature) can be superseded. This foreshadows my discussion in chapter 5 where I give an interpretation of the famous passage from Capital 3 which diverges from the standard interpretation. Here I want to stress that the German Ideology can be read in exactly the same way. Marx conceives of the reappropriation of the productive forces as synonymous with the development of individual capacities. Since the productive forces have developed to a totality,

> "this appropriation must have a universal character corresponding to the productive forces and the intercourse. The appropriation of these forces is itself nothing more than the development of the individual capacities corresponding to the material instruments of production." (CW 5:87)

The discussion in this chapter, and in the following section 3.1.2., concentrates on Marx's discussion of technological evolution which seems a challenging enterprise, for it seems that a tension in his theory arises exactly here: a tension between his historical and critical analysis. As I shall show, this tension takes the form of an opposition between a technological evolution and his humanist claims.[96] In the present chapter, I limit the

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96 As Rottleuthner, in another context, put it: "The concepts of organism and development are linked by their ambivalent and therefore broad political applicability. Development can easily be linked with dynamism and progress, with directions and goals of development, which recall the ideals of perfectability of the 18th century. But 'development' was also ...

analysis to the question if technology evolves; in the next chapter, I embark on the question if technology is autonomous.

3.1.2. Evolution and Technological evolution

The major source in studying this subject is the recently published manuscript Zur Kritik der Politischen Ökonomie 1861-63 (Manuscripts 1861-3 for short)[97] where Marx presents, over hundreds of pages, major contributions on technology. Already a superficial glance into the table of contents shows the importance which Marx attributed to this subject. In Abteilung II, volume 3.1., we find under the heading "Der relative Mehrwert" over a hundred pages dedicated to cooperation, division of labour and machinery. In volume 3.6., Marx returns to the same questions again. Just to show how close Marx did study matters of technology, I shall draw to a great extent on passages from this work (apart from more common sources) which has only recently been published (in German).

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linked ... with the aspect of objectivity, a context which was remote from the deliberate, goal-directd action of men. The forces or regularities of development act inevitably. History cannot be made." (Rottleuthner 1988:110-1)

97 In fact, parts of these manuscripts had been published from 1905-1910 under the title Theorien über den Mehrwert, edited by Karl Kautsky, and from 1954-1961 by the Institute for Marxism-Leninism at the Central Committee of the CPSU. These editions consisted mainly of notebooks V-XV and XX-XXIII; the new edition of the Marx-Engels-Gesamtausgabe contains all the notebooks.

Marx conceives the development of the productive forces, and of relations of production, in an evolutionary perspective. He refuses a viewpoint which would treat the individual inventor as the focus of attention. Indeed, in the beginning of the chapter on "Machinery and Modern Industry" in the first volume of Capital, Marx writes:

> A critical history of technology would show how little any of the inventions of the 18th century are the work of a single individual. Hitherto there is no such book. Darwin has interested us in the history of Nature's technology, i.e. in the formations of the organs of the plants and animals, which organs serve as instruments of production for sustaining life. Does not the history of the productive organs of man, of organs that are the material basis of all social organization, deserve equal attention? (Capital 1:352 fn)

A hundred years later this question has still not received the attention it deserves. As Rosenberg rightly observes, this passage from Capital "amazingly fresh over a century later, reads like a prolegomenon to a history of technology that still remains to be written." (Rosenberg 1982a:40)

The reference to Darwin comes out even more clearly in the Manuscripts (1861-3). Marx explicitly refers to On the Origin of Species where Darwin distinguishes between the lower and higher forms of organization of living beings. The criteria for drawing this distinction is the differentiation of organs. Since Marx gives a summary of the passage in German, let me reproduce the English original here. Darwin writes:

> "I presume that lowness in this case means that the several parts of the organization have been but little specialised for particular functions; and as long as the same part has to perform diversified work, we can perhaps see why it should remain variable, that is, why natural selection should have preserved or rejected each little deviation of

> form less carefully than when the part has to serve for one special purpose alone. In the same way that a knife which has to cut all sorts of things may be of almost any shape; whilst a tool for some particular object had better be of some particular shape. Natural selection, it should never be forgotten, can act on each part of each being, solely through and for the advantage of each being." (Darwin 1859/1971:141)[98]

Marx is inspired directly by Darwin and uses an analogy between biology and technology.[99] He transposes this distinction to technology in the broad sense (including division of labour, tools, machinery etc.)

> "Die durch Theilung der Arbeit in der auf sie begründeten Manufactur gegebne Differenzierung, Specialisirung und Vereinfachung der Arbeitsinstrumente - ihre exclusive adaptation to very simple operations - ist eine der technologischen, materiellen Voraussetzungen für die Entwicklung der Maschinerie als eines die Productionsweise und Productionsverhältnisse revolutionirenden Elements." (MEGA II.3.6.:1914; emphasis added)

Marx was convinced that the historical development of technology which is man's organic nature (see 3.1.1.) cannot be explained by

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98 It should be mentioned that Darwin rejected the common equation of evolution with progress (Gould 1973:36).

99 It is most interesting that Darwin intuitively conceived of the development of tools and of organs in the same evolutionary way. The Marx/Darwin relation has been a controversial topic. This seems to be due to Marx's ambivalent attitude towards Darwin, see Groh (1967), Avineri (1968), Gerratana (1973), Ball (1979). Marx fiercely rejects the formula "struggle for life" which is a basic theme of Malthus. In a letter to Kugelmann, Marx stresses that this formula is a mere Phrase which is as void (and false) as Malthus's law of (over-)population. See Marx to Kugelmann, 27.6.1870. In a letter to Lassalle, he praises Darwin for having destroyed teleology in the natural sciences (see letter of 16.1.1861).

individual behaviour (inventions). Rather, it needs to be explained by an approach which conceives the development of technology from an observer's standpoint, i.e. as evolution.[100] As Weick put it:

> What occurs is simply that an observer watches events happen, imposes on these happenings some preconception about order, and this preconception then allows the observer to watch the changing instances, compare them, and see whether there is a progression toward orderliness in those portions being observed. If there is, evolution has occurred." (Weick 1979:119)

In the above passage Marx alludes to the mechanism of "adaptation" which makes us ask: does it make sense to suggest similarities between the adaptation of a biological species to an environment and a technology which adapts to "very simple operations"? Are we not led astray by Marx's application of Darwin's criteria to technology? Darwin suggests that evolution is a process of natural selection which operates by means of variation. The "goal" of evolution, however, is not variation (nor is it selection or inheritance). These are only the means to secure the survival of the species and to reach an increase in reproductive capacity of the species.[101] This is not to say that the suggested similarities are devoid of heuristic value. Weick pointed out that "a surprisingly rich introduction to theories of evolution can be obtained with a simple deck of playing cards. If the deck is

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100 "A critical history of technology would show how little any of the inventions of the 18th century are the work of a single individual." (Capital 1:352 fn).

101 According to Gould, we may distinguish between two main strategies for enhancing reproductive capacity: r- and K-strategies. The former are directly maximising reproduction, the latter are adapting ("fine-tuning") to the environment. See Gould (1973:94).

shuffled repeatedly, it is clear that there is continual change as the cards become rearranged, but does the deck evolve? It all depends. Some people are willing to accept any rearrangement of parts as evolution, whereas others would say that some order must occur out of chaos before it can be said that evolution is occurring." (Weick 1979:119) Technology and the deck of cards are similar in that they do nothing by themselves: technology needs to be designed and produced, a deck of cards needs to be shuffled.[102]

There are two main objections to an evolutionary approach within social theory. The first contends that the natural and the social world are different in that the social world is characterized by intentional human action. The second rejects the use of biological models in the social sciences in a more principled way. I comment on both objections in turn.

(1) It is true that evolution in the biological, and evolution in the socio-cultural (including technological) sphere are distinct. The most important difference is that the latter does not depend on the selection of mutations, since the possibility of new combinations is given in each generation (cf. Luhmann 1984a:589). This leads to an enormous acceleration of evolution.

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102 See Luhmann who on the one hand declares that a series of structural changes may be described and interpreted as evolution (from an observer's standpoint; cf. Luhmann 1983: 194), but on the other hand says that socio-cultural evolution can only exist on the level of society and its subsystems (Luhmann 1983:196). Since society is defined by meaningful communications (and only by them), technology seems to fall outside the scope of evolutionary theory. This is confirmed by his assertion that society consists of events which vanish in the moment of their emergence (cf. ibidem,197). In the model which I propose, technology is defined as an enduring trait of society which does not vanish in the moment of its emergence.

As Enzo Tiezzi wrote in his instructive Tempi storici, tempi biologici:

> "Il tempo biologico è quella cosa con cui si misura l'evoluzione biological e la sua unità di misura per studiare il passato è dell'ordine di grandezza di millioni di anni: miliardi di anni ci separano dall'origine della Terra; centinaia di millioni di anni dalla comparsa di alghe, batteri, trilobiti, artropodi, pesci; 3 millioni di anni della comparsa dell'uomo. Ma il tempo biologico è anche quella cosa con cui si deve misurare il futuro e la rottura degli equilibri biologici sta inducendo variazioni a livello planetario in tempi talmente brevi da accelerare l'orologio geologico. Trasformazioni che prima avvenivano in millioni di anni possono ora avvenire ... in poche decine di anni e le conseguenti variazioni per gli equilibri umani e sociali corrisponderanno a un'accelerazione di millioni di anni di storia." (Tiezzi 1984:62)

Biological and socio-cultural evolution are thus taking place at different speeds and different rhythms which may lead to ecological problems. It may occur that the fast evolution of society does not permit for an adaptation of some biological species (either of the K- or r- type). To the extent that social evolution depends on these species, it itself in turn will be endangered.

Unlike Elster, and othhers, I do not see the decisive difference between biological and social evolution as resting on the latter being characterised by intentional human action. The decisive difference is that the social realm evolves at a much faster rate than the biological realm. Also, Ball (1979) juxtaposes natural and social evolution: "The opening chapter of his Origin notwithstanding, Darwin fails to see that conscious human selection is, when weighted on the scales of human history, vastly more significant a factor in evolution than is natural selection through chance and accident. Because of human attempts to transform

nature, 'natural history' is fast becoming 'human history.' Human purpose and praxis are replacing chance and accident as the motive force of evolution." (Ball 1979:473) But Ball is doubly mistaken. First he neglects the fact that for Marx capitalist societies cannot be called human societies since they still belong to what he called "natural history" (see 1859 Preface).[103] Second, following directly from the first point, he does not interpret the decisive difference between natural and social evolution as in the first place a difference in relative speeds of evolution, but as a difference between intentional action which, according to him, replaces chance and accident. To repeat: at least for Marx such a state of affairs could be established only in communism (the truly human society), and not in pre-communist societies.

Ball concludes that the "Marx-Darwin-myth" was completely unfounded. However, there is something which does not fit into Ball's account and which makes understandable a claim like Feuer's, viz. that Marxism rests on Darwinian evolution (cited in Ball 1979:479-80): Marx, while clearly seeing the differences between natural and social evolution and amusing himself about Darwin's identification of nature with the free-market categories of capitalism, nevertheless tries to develop his own theory of social evolution. In this respect Engels' speech at Marx's graveside (where he called him the Darwin of the social world) was not without justification. As Luhmann rightly pointed out:

> "Darwin's theory of evolution represents a radical break with all earlier traditions of

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103 Karl Korsch (1938) rightly emphasised that the crucial point for Marx was the overcoming of the naturwüchsige traits of society. This word cannot be translated adequately into English with only one word. Marx uses it in a pejorative sense here; it means that people are confronting society as something they do not understand or they can do nothing about. I shall translate it with the English word "natural".

> thinking about development and perfection, of history and order. It is no longer an intelligent cause, no longer God's design, but simply a difference that makes the difference. All 'grand theory' of the 19th century uses this scheme of thought. So did Hegel, and, of course, Marx." (Luhmann 1984c:61)

There are various thinkers who have tried to adapt an evolutionary model to the social sciences, among them Donald Campbell. He tried to summarise the main mechanisms of evolution in the following way:

> For an evolutionary process to take place there need to be variations (as by mutation, trial, etc.), stable aspects of the environment differentially selecting among such variations and a retention-propagation system rigidly holding on to the selected variations. The variation and the retention aspects are inherently at odds. Every new mutation represents a failure of reproduction of a prior selected form. Too high a mutation rate jeopardizes the preservation of already achieved adaptations. There arise in evolutionary systems, therefore, mechanisms for curbing the variation rate. The more elaborate the achieved adaptation, the more likely are mutations to be deleterious, and therefore the stronger the inhibitions on mutation. For this reason we may expect to find great strength in the preservation and propagation systems, which will lead to a perpetuation of once-adaptive traits long after environmental shifts have removed their adaptedness." (Campbell 1965, cited in Weick 1979:122)

Several authors have transposed this model to socio-cultural evolution. For Luhmann, social-cultural evolution is evolution in the strict sense, too. As he pointed out,

> "Trotz all dieser Unterschiede von organischer und soziokultureller Evolution ... handelt es sich auch bei der soziokulturellen Evolution um Evolution im strikten Sinne, nämlich um einen ohne Plan bewirkten Aufbau von

> hochunwahrscheinlicher Komplexität." (Luhmann 1984a:590)

Note that Luhmann defines evolution (both in the biological and the socio-cultural sense) as leading to an increase in complexity (see also Ballmer and von Weizsäcker, 1974). This complexity is the result of selections of individual ("improbable") variations (mutations) and thus an improbable event. Evolutionary theory, then, would have the task of explaining how it came about that (both in the natural and social world) highly improbable constellations were selected and stabilised.[104] Habermas also tried out possible uses which can be made of evolutionary models in the social sciences. Although it is very tentative, his article is worth mentioning here. He asks what sense it makes to transfer such categories as "variation" and "increase in complexity" to society. As to the latter he rightly comments that "increase in complexity" is no sufficient criterion for establishing an evolutionary hierarchy if we do not know the inner logic of the organisms (Habermas 1976:190). Habermas sees the increasing "learning potential" of societies more as the driving force of development. However, as Gould has convincingly pointed out, we can derive these criteria by looking at how organisms succeed in

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104 See also Gould's stress on the important role played by increasing complexity: "Either plants or animals. Our basic conception of life's diversity is based upon this division. Yet it represents little more than a prejudice spawned by our status as large, terrestrial animals." (Gould 1973:113) Gould then adopts the five-kingdom typology of Whittaker "because it tells a sensible story about organic diversity. It arranges life in three levels of increasing complexity... [E]volutionary transition from any level to the next occurs more than once; the advantages of increased complexity are so great that many independent lines converge upon the few possible solutions. The members of each kingdom are united by common structure, not by common descent." (Gould 1973:117)

handling the balance between size and shape (see Gould 1973). By analogy, if we dissect society in social subsystems, we can formulate the criterion that each subsystem must be able to secure its own maintenance, given its level of complexity and its operating codes. The "goal", so to speak, of its operations thus lies, similarly to natural processes, in securing the continuation of its own operations.[105]

(2) One might wish to reject the use of biological analogies in a more rigorous way. Indeed, it is common in the social sciences to be highly sceptical of models or theories which are imported from biology.[106] Biological analogies and metaphors are to be found also in Marx.[107] I shall thus make a general remark about analogies as such and about biological analogies in Marx and my own study.

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105 At the time Habermas wrote his article, Luhmann hadn't yet taken his "autopoietic turn". But Habermas already objected to "hopeless circles of self-referential definitions" in Luhmann's and Dunn's efforts in establishing criteria analogous to the survival-criterion in biology.

106 Needless to say, I share this scepticism regarding sociobiology and social darwinism. For a critique, see Gould (1973) and Hofstadter (1944).

107 See the afterword to the second edition of Das Kapital, where Marx cites with approval a Russian reviewer of his book, who pointed out that it was Marx's method to examine the evolution of social and economic forms, "in a word, economic life offers us a phenomenon analogous to the history of evolution in other branches of biology. The old economists misunderstood the nature of economic laws when they likened them to the laws of physics and chemistry. A more thorough analysis... shows that social organisms differ among themselves as fundamentally as plants or animals." (Capital 1:28) Marx comments that this generous review portrays nothing other than his dialectical method.

Gregory Bateson remarked once that it is a feature of the human brain to think with the help of what he called "abductions". This is to say that our perception is guided by specific experiences and concepts. If we encounter something new, we try to explain it with common or known ("old") categories, models or theories.

> Diese laterale Ausdehnung abstrakter Beschreibungskomponenten wird Abduktion genannt ... Jede Abduktion läßt sich als eine doppelte oder vielfache Beschreibung irgendeines Objekts, irgendeines Ereignisses oder irgendeiner Sequenz auffassen... In beiden Fällen wird angenommen, daß gewisse formale Characteristika eines Bestandteils in dem anderen in dem anderen spiegelbildlich wiederkehren werden. (Bateson 1982:179)

As to the second point, it has been noted by several authors that Marx deliberately tried to develop his theory with analogy to the natural sciences. Alfred Schmidt already pointed out that in Marx we find "strange biological metaphors" in describing man's relationship to nature. (Schmidt 1971:78) Schmidt cites Moleschott and Liebig who both employed the term Stoffwechsel which Marx acquired from them. Moleschott wrote that the soul of the world consists in a circulation of matter (cf. Schmidt 1971:86). The German philosopher Schelling also used this notion to develop parts of his natural philosophy. Indeed, the title of one of his writings is called "Von der Weltseele, eine Hypothese der höheren Physik zur Erklärung des allgemeinen Organismus" (Schelling 1798)[108]. The curious thing with Moleschott and Liebig is that they coin the term Stoffwechsel with analogy to social concepts: Moleschott makes reference to commerce, Liebig to politics. We have thus to take into account that at least some categories in

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108 It is worth noting that Schelling's philosophy has also been interpreted as a forerunner of the new paradigms of self-organisation, self-reproduction and autopoiesis - see Heuser-Keßler (1986:52).

the natural sciences were coined by explicit or implicit reference to social phenomena. This reciprocal process has also been noted by Schmidt:

> Wie seit der Antike die Veränderung gesellschaftlicher Gebilde bis hin zu Machiavelli und Pareto als naturgesetzlicher Kreislauf verstanden worden ist, so findet sich auch schon ebenso früh der Versuch, die Veränderung und wechselseitige Umsetzung der Naturdinge vermittels gesellschaftlicher Kategorien zu deuten." (Schmidt 1971:91)

As we just have seen, Darwin also can be added to this list; he also tried to make plausible the use of a concept (differentiation) by means of an analogy, in this case to the technical world (see his knife-example). Furthermore, Darwin also transposed a mechanism from the social world to the natural world, namely Malthus' "struggle for existence" (see Rottleuthner, 1987:109) - a procedure which amused Marx.[109] Lepenies (1976) has shown that the concept of division of labour went back and forth between sociology and biology: "Spencer spoke of reciprocity (Wechselwirkung) as he showed that biology borrowed the concept of division of labour from sociology in order to return it in an enriched form. Reciprocity signifies the transfer of a concept from one scientific discipline to another and then back into the original discipline." (Lepenies 1976:172, cited in Rottleuthner 1987:101)

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109 See the letter to Engels of 18.6. 1862: "It is remarkable how Darwin recognises among beasts and plants his English society with its division of labour, competition, opening up of new markets, inventions and the Malthusian 'struggle for existence'. His [nature] is Hobbes' bellum omnium contra omnes and one is reminded of Hegel's Phenomenology, where civil society is described as a 'spritual animal kingdom', while in Darwin the animal kingdom figures as civil society."

To come to my own use of such analogies: as will become clear in the following discussion, evolutionary concepts in social theory indeed borrow much from biology (see Weick 1979). There are several authors who believe that central notions of evolutionary theory can be put to use in the explanation of social phenomena and social change. In chapter 4, I shall test the potential of such an approach in comparison to the standard marxist approach (as expressed in the 1859 Preface).

3.1.3. Marx's machine definition

Now look at Marx's definition of what a machine is. He rejects several definitions among them the following:

> "Die Erklärung, daß machine a complicated tool und a tool a simple machine erklärt nichts. Die Erklärung, daß Maschine, wo das Werkzeug nicht durch Menschenkraft bewegt und Werkzeug, wo der Mensch Prime Mover, erklärt einen Hundekarren... für eine Maschine, dagegen einen mechanischen Strumpfwirkstuhl... für ein Werkzeug. Enthält kein Moment, woraus sich der social change erklärt." (MEGA II.3.6.:1951, my emph.)

In a letter to Engels he explained several attempts to define a machine:

> "You may or you may not know, for of itself the thing's quite immaterial, that there is considerable controversy as to what distinguishes a machine from a tool... if we take a look at the machine in its elementary form, there can be no doubt that the industrial revolution originates, not from motive power, but from that part of machinery called the WORKING MACHINE by the English, i.e. not from, say, the use of water or steam in the place of the foot to move the spinniing wheel, but from the transformation of the actual spinning process itself, and the elimination of that part of human labour that was not mere

> EXERTION OF POWER (as in treadling a wheel), but was concerned with processing, working directly on the material to be processed." (Letter to Engels, 28.1.1863)

Marx aims to identify a technological element which is able to produce social change.[110] He thus rejects both the defintion of the English technologists who "call a tool a simple machine and a machine a complicated tool" (ibidem) and the definition of the "German jackasses, who are great on little matters like this" (ibidem) and call a plough a machine because it is not moved by

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110 The point for Marx is not to have a good definition for its own sake but to have a definition which is able to capture the advent of the industrial revolution; and it is precisely here that the definitions of the Englishmen and the Germans fail. Marx emphasises his special interest when he admits that "[t]o those who are merely mathematicians, these questions are of no great moment, but they assume great importance when it comes to establishing a connection between human social relations and the development of these material modes of production." (Letter to Engels of 28.1.1863, my emph.) According to Marx, then, the important difference is the existence of a mechanism, which can be found in the models of the clock and the mill. According to him, "[t]he clock was the first automatic device to be used for practical purposes, and from it the whole theory of the production of regular motion evolved." (ibidem) Marx is aware that machines (which conform to this definition) have been employed for a long time. But with their use on a broader level a specific dynamics occurs: "The industrial revolution began as soon as mechanical means were employed in fields where, from time immemorial, the final result had called for human labour and not therefore - as in the case of the above-mentioned tools - where the actual material to be processed had never, within living memory, been directly connected with the human hand; where, by the nature of things and from the outset, man has not functioned purely as POWER." (ibidem)

human power.[111] Instead, he agrees with Babbage who defines the machine in the following way:

> "Quand par la division du travail, chaque opération particulière a été réduite à l'emploi d'un instrument simple, la réunion de tous ces instruments, mis en action par un seul moteur, constitue une machine." (Babbage 1833, cited in MEGA II.3.6.:1914).[112]

Marx comments: "Was wir hier hervorheben, ist nicht nur die Reduction de "chaque opération particulière à l'emploi d'un instrument simple", sondern, was drin involviert ist, die aus der Theilung der Arbeit entspringende creation dieser instruments simples." (MEGA II.3.6.:1914) It is not important what the motor is. It may be the human hand and foot, animal powers, elementary powers or an automaton (mechanical powers) (cf. MEGA II.3.6.: 1914). The only important thing is that virtuosity and skill get transposed from the worker to the mechanism: "Aber solche Operationen, die früher des Virtuosen bedurften, der auf dem Instrument spielte, jezt hervorgebracht durch die Verwandlung der durch den einfachsten mechanischen Anstoss (Kurbel drehen, Rad treten) von

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111 In a letter to Engels he admits to be "in considerbale doubt about the section in my book that deals with machinery. I have never been quite able to see in what way SELF-ACTORS changed spinning, or rather, since steam power was already in use before then, how it was that the spinner, despite steam power, had to intervene with his motive power." (Letter from 24.1.1863) And, in the letter from 28 January of the same year: "For me, mechanics presents much the same problem as language. I understand the mathematical laws, but the simplest technical reality that calls for ocular knowledge is more difficult for me than most complicated combinations." For this reason, Marx was attending a practical course for working men in the Institute of Geology (cf. CW 41:446, 449).

112 Cf.also The Poverty of Philosophy, CW 6:186, as cited above.

Seiten des Menschen, unmittelbar bewirkten Bewegung in die raffinirten Bewegungen der Arbeitsmaschine." (MEGA II.3.6.:1917, my emph.)[113]

Machinery rests upon simple cooperation and division of labour, but changes them at the same time:[114]

> "Die Maschinerie - sobald sie capitalistisch angewandt wird...- sezt die einfache Cooperation voraus und zwar erscheint diese... als viel wichtigeres Moment in ihr, wie in der auf Theilung der Arbeit beruhenden Manufactur... Die in der Manufactur entwickelte Theilung der Arbeit wiederholt sich einerseits im Innern des mechanischen Ateliers, obgleich in sehr vermindertem Maaßstab; andererseits, wie wir später sehn werden, wirft das mechanische Atelier die wesentlichsten Principien der auf Theilung der Arbeit beruhenden Manufactur über den Haufen. Endlich vermehrt die Anwendung der Maschinerie die Theilung der Arbeit im Innern der Gesellschaft, die Verfielfältigung der besondren Geschäftszweige und unabhängigen Productionssphären. Ihr Grundprincip ist die Ersetzung geschickter Arbeit durch einfache Arbeit..." (MEGA II.3.1.:294, my emphasis)

Marx distinguishes historically two stages of transition to machine work. The first is the development of machines which have their origin in primitive tools and which eventually led to the production of machines by means of machines.

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113 See also the following passage from the Grundrisse: "[I]t is the machinery which possesses skill and strength, is itself the virtuoso, with a soul of its own in the mechanical laws acting through it... The workers' activity, reduced to a mere abstraction of activity, is determined and regulated on all sides by the movement of machinery and not the opposite." (Grundrisse:693)

114 See 3.6. for a discussion of his concept of "division of labour".

> "Als die beiden klassischen Beispiele der Maschinerie, die auf diesem verschiednen Weg hervorgeht, sind zu betrachten: auf der einen Seite die Spinn- und Webmaschinen, die aus den urältesten ... Werkzeugen hervorgingen... Auf der andren Seite die Fabrikation der Maschinen selbst durch Maschinerie... Historisch geht die Umwälzung in der Industrie von der ersten Form aus. Es liegt in der Natur der Sache, daß erst nachdem die Fabrikation der Waaren durch Maschinerie einen gewissen Umfang erreicht hat, das Bedürfniß sich fühlbar machte, die Maschinen selbst durch Maschinen zu produzieren." (MEGA II.3.6.:1915)

In the case of the spinning machine, the worker was reduced to merely driving the wheel. The mass of the product was no longer in direct proportion to the physical expense of power. The decisive feature of machinery is that a mechanism performs operations which earlier were performed by a virtuoso who played an instrument:

> "Von dem Augenblick, wo die menschliche direkte Betheiligung an der Production nur noch darin bestand, daß er als einfache power wirkte, das Princip der Arbeit durch Maschinerie gegeben. Der Mechanismus war da; die Triebkraft selbst konnte später durch Wasser, Dampf etc ersetzt werden." (MEGA II.3.6.:1917)

The second stage is characterized by the employment of the steam engine: "Nach dieser ersten großen industriellen Revolution, war die Anwendung der Dampfmaschine als Bewegung producirende Maschine die zweite." (MEGA II.3.6.:1917) The historical turning point, however, is expressed in the first stage (transfer of skill), for the simple reason that mankind always had living automatons (=animals) which served as a power source. The important difference has to be seen in the instrument. The plough contained no element which could lead to the industrial revolution: all movements of men and animals were essentially those of free will, the movement was irregular; man had to direct the animals. The mechanical act was hidden behind the movement of man and animal:

they themselves were not forced into a strict geometry. The mill, however, can be regarded as the forerunner of machinery; it is the first "Arbeitswerkzeug" (see MEGA II.3.6.:1919). "Auch dieser Punkt der Maschinerie an der Mühle entwickelt, daß früher von dem eigentlichen Mahlen getrennter Theil der Arbeit, selbständige Arbeit, durch dieselbe Triebkraft verrichtet und somit der Arbeit des Mahlens mechanisch combinirt wird." (MEGA II.3.6.:1920-1). It is most important to keep in mind the differentia specifica of the machine as defined by Marx. It is the transfer of technical skill from the worker to the instrument. Recall, also, Marx's definition from the Grundrisse where he said that the machine is the virtuoso which possesses a soul of its own. In Capital, Marx shifts the attention from the technological to the social level (see 3.5.).

But let us return to the consequences of Marx's machine definition. The effects on the character of the labour performed under these conditions are summarized as follows:

> "Einmal die verwandelte Form der Arbeit, ihre scheinbare Leichtigkeit, die alle Muskelanstrengung auf die Maschinerie wirft, ebenso das Geschick. Die Verlängerung [der Arbeitszeit, R.G.] stößt aus dem einen Grund zunächst nicht auf physische Unmöglichkeit; an dem zweiten bricht der Gegensatz des Arbeiters, dem seine noch bei der Manufactur vorherrschende, jezt gebrochne Virtuosität nicht mehr erlaubt sich auf die Hinterfüsse zu stellen, vielmehr dem Capital erlaubt die geschickten Arbeiter durch ungeschickte und daher seiner Controlle mehr unterworfne zu ersetzen." (MEGA II.3.1. 303, my emph.)

This new reality, which is in the first instance a technological one, has tremendous social consequences, and negative ones for the workers. Marx says that a new class of workers i.e. women and children, is entering the production process which is completely obiedient to the despotism of capital. Furthermore, capitalist use of machinery lengthens the working day instead of shortening it:

"Ist einmal durch Tradition der Arbeitstag gewaltsam verlängert, so erheischt es Menschenalter, wie in England, bevor die Arbeiter fähig sind ihn wieder auf die Normalgrenzen zurückzuführen." (ibidem)

3.1.4. The machinery question

"The machinery question in early nineteenth-century Britain was the question of the sources of technical progress and the impact of the introduction of the new technology of the period on the total economy and society. The question was central to everyday relations between master and workman but it was also of major theoretical and ideological interest. The very technology at the basis of economy and society was a platform of challenge and struggle." (Berg 1982:9).

Basically, there were two attitudes towards machinery: one which welcomed it and saw it as an instance of progress; another which condemned it, stressing its de-humanizing effects. The following quote from John Stuart Mill may serve as an example of the first attitude: "The more visible fruits of scientific progress... the mechanical improvements, the steam engine, the railroads, carry the feeling of admiration for the modern, and disrespect for ancient times, even down to the wholly uneducated classes." (Mill, "M. de Tocqueville on Democracy in America", cited in Berg 1982:11) The counter-position was expressed by writers like Thomas Carlyle or Charles Dickens. Carlyle's cultural critique comes out clearly when he compares "the living artisan" with the inanimate one: "The huge demon of Mechanism smokes and thunders, panting at his great task, in all sections of English land;changing his shape like a very Proteus; and, infallibly, at every change of shape, oversetting whole multitudes of workmen, as if with the waving of

his shadow from afar, hurling them asunder, this way and that, in their crowded march and curse of work or traffic." (Carlyle 1980, vol.23:24 as cited in Berg 1982:12)

Marx was caught between these attitudes. He saw both the progressive character of machinery but also its debasing effects.[115] He tried to combine both positions, pointing to a higher form of industrial society where the negative features would have vanished. Carlyle depicted machinery as a "huge, dead, immeasurable steam engine, rolling on, in its dead indifference." (Carlyle, Sartor Resarus, cited in Berg 1982:12) Marx, in Capital, describes a "mechanical monster whose body fills whole factories, and whose demon power, at first veiled under the slow and measured motions of his giant limbs, at length breaks out into the fast and furious whirl of his countless working organs." (Capital 1:381-2)

This expresses a feeling of anxiety felt by many contemporaries of Marx and still felt by many people today.[116] When Dickens complained that in modern society everything was quantified, mechanised, calculated as "so many hundred hands in this mill; so many hundreds horse steampower"[117], Marx would stress the potential for liberating mankind on the basis of this scientific method. In Capital he praises Modern Industry in the following way:

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115 The latter are sharply expressed in the early Paris Manuscripts, but also in Capital. The difference is that Capital conceives the debasing effects as due only to the capitalist use of machinery.

116 Charles Babbage also expressed such an anxiety - see Berg (1980:11-2).

117 Dickens, Hard Times, as cited in Berg 1980:13.

> "Modern Industry rent the veil that concealed from men their own social process of production and that turned the various, spontaneously divided branches of production into so many riddles, not only to outsiders, but even to the initiated. The principle which is pursued, of resolving each process into its constituent movements, without any regard to their possible execution by the hand of man, created the new modern science of technology. The varied, apparently unconnected, and petrified forms of the industrial process now resolved themselves into so many conscious and systematic applications of natural science to the attainment of given useful effects." (Capital 1:486)[118]

From this quote at least we may conjecture that Marx ultimately gave more emphasis to the progressive aspect of machinery than to the "spiritual" consequences.[119] This has to do with the emancipatory role he attributed to science, as we shall now see.

3.1.5. Science and technology

It is a commonplace that the main facet of modern technology is the growing influence of science. Little agreement exists on whether science or technology have a prius over the other, or more

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118 There is a passage in the Grundrisse where Marx takes this view to extremes: "No longer does the worker insert a modified natural thing [Naturgegenstand] as middle link between the object [Objekt] and himself; rather, he inserts the process of nature, transformed into an industrial process, as a process between himself and inorganic nature, mastering it. He steps to the side of the production process instead of being its chief actor." (Grundrisse:705)

119 To be sure, this is also the way in which mainstream Marxism presented its answer to the question of "technical progress".

generally, how the relation between the two has to be conceptualized. In a recent debate, Fores denied the scientific character of technology (modern or otherwise). He maintains that there is nothing identifiable which could be called technology; it is only Technik which is worth talking about. According to him, "it makes no more sense to ask an engineer to be 'scientific' than to ask a lawyer to 'be seamanly' or a sailor to 'act like a good cook'." (Fores 1988:71). In his view, engineering science is a 'myth'. However, this view is contrary to a long tradition of conceptualizing modern technology which I cannot represent adequately here for reasons of time and space. Suffice it to say, that from Ure, Babbage, and Marx onwards, technology's main characteristic was seen in the growing application of scientific findings. This does not mean that technology has to await some "ordered" scientific results, or that technology is "applied science"; rather it means that modern technology as such incorporates skills, knowledge and experience, and thereby some - at least minimal - scientific knowledge.[120] However, Fores is right to insist on the distinction between science and technology. In order to pursue this issue further, I now explore Marx's thought on this matter, confronting it with some contemporary analyses.

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120 Scheler (1980), in an illuminating study, has claimed that it is logic, mathematics and the practice of observing and measuring that form the driving force for technical development (basic to both science and technology is the Machtgedanke, the will to power). Scheler thinks that Technik does not in the first place consist in constructing "economically efficient" machines, but, following its own logic, is aiming at constructing all possible machines: "Der Grundwert, der die neue Technik leitet... geht auf das Ziel... alle möglichen Maschinen zu konstruieren und zwar zunächst nur in Gedanken und als Plan." (Scheler 1980:125) Only after that are two further selections made: one by the engineer, the other by the entrepreneur (cf. id.,127); see also Rapp (1978:70). I come back to Scheler in 3.3.

Marx conceives the relationship between science and technology under capitalism in the following way:

> In machinery, the appropriation of living labour by capital achieves a direct reality in this respect as well: it is, firstly, the analysis and application of mechanical and chemical laws, arising directly out of science, which enables the machine to perform the same labour as that previously performed the worker. (Grundrisse:705)[121]

Marx's very concept of the machine would not work without the role of science. As he propounded at length in Capital, it was only with the emergence of machinery that science could be applied to the production process in an unprecedented way. Rosenberg observed: "By breaking down the productive process into objectively identifiable component parts, it creates a structure of activities which is really amenable for rigorous analysis." (Rosenberg 1976b:133). Marx himself put it this way:

> The principle, carried out in the factory system, of analysing the process of production into its constituent parts, and of solving the problems thus proposed by the application of mechanics, of chemistry, and of the whole range of the natural sciences, becomes the determining principle everywhere." (Capital I:434)

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121 In the following statement in the Manuscripts he fairly exaggerates the influence of science upon technology when he says that every scientific discovery serves as a base for a new technological invention: "Jede Entdeckung wird Basis neuer Erfindung oder neuer verbesserter Methoden der Production. Erst die kapitalistische Productionsweise macht die Naturwissenschaften dem unmittelbaren Productionsprozeß dienstbar, während umgekehrt die Entwicklung der Production die Mittel zur theoretischen Unterwerfung der Natur liefert... Das Capital schafft die Wissenschaft nicht, aber es expoloitiert sie, eignet sie dem Produktionsprozeß an. Damit zugleich Trennung der Wissenschaft, als auf die Production angewandter Wissenschaft von der unmittelbaren Arbeit." (MEGA II.3.6.:2060)

This is a quite recent phenomenon. To be sure, science and capital have existed for centuries without giving rise to the above described process of analysing the production process and applying scientific knowledge to it. "It is only at a very recent point in history, Marx argues, that the marriage of science and industry occurs. Moreover, this marriage does not coincide with the historical emergence of capitalism." (Rosenberg 1976a:130). In modern industry, technology is for the first time not designed in accordance with physical endowments of the workers "but in accordance with a completely different logic, a logic which explicitly incorporates principles of science and engineering." (Rosenberg 1976a:132)

But the mere growth of science is not a sufficient condition for the growth of productivity. Neither is it justified to think of technology as application of scientific knowledge. As Rosenberg put it, "this perspective obscures a very elemental point: technology is itself a body of knowledge about certain classes of events and activities. It is not merely the application of knowledge brought from another sphere... It is... not a fundamental kind of knowledge, but rather a form of knowledge that has generated a certain rate of economic progress for thousands of years." (Rosenberg 1982b:143)

Thus technology may develop on its own, without the guiding function of science. Marx was also aware of this when stressing the "eigendynamics" of technology:

> Invention then becomes a business, and the application of science to direct production itself becomes a prospect which determines and solicits it. But this is not the road along which machinery, by and large, arose, and even less the road on which it progresses in detail. The road is rather dissection [Analyse] - through the division of labour, which gradually transforms the workers'

> operations into more and more mechanical ones, so that at a certain point a mechanism can step into their places. (Grundrisse:704, my emph.)[22]

It is doubtful if Marx would have agreed with attributing the following characteristics to a communist society:

> [T]he normal situation in the past and to a considerable degree also in the present, is that technological knowledge has preceded scientific knowledge... Thus, it is to be expected that feasible technological knowledge is likely to be attained before the deeper level of scientific understanding. At least this is so if sufficiently powerful economic incentives are at work." (Rosenberg 1982b:144)

Perrow, analysing high-risk systems, points out that poorly-designed or poorly-understood technological systems are likely to lead to accidents:

> Transformation processes exist in recombinant DNA technology, chemical plants, nuclear power production, nuclear weapons, and some aspects of space missions. Most of these are quite new, but it is significant that chemical processing is not. While experience has helped reduce accidents, accidents continue to plague transformation processes that are fifty years old. These are processes that can be described but not really understood. They were often discovered through trial and error, and what

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122 See Hegel: "Wenn sich aber die Fabrikarbeit so vervollkommnet, so vereinfacht ist, so kann statt des maschinenmässigen Arbeitens der Menschen die Maschine arbeiten, und dieses ist der gewöhnliche Übergang in den Fabriken..." (Hegel 1983b:127) Avineri comments: "We thus have here, in one of the most speculative documents of German idealist philosophy, one of the most acute insights into the working of modern, industrial society: from a priori philosophical anthropology, Hegel moves on to incorporate the results of political economy into a philosophical system - an attempt almost identical in its systematic structure with Marx's program forty years later." (Avineri 1972:94)

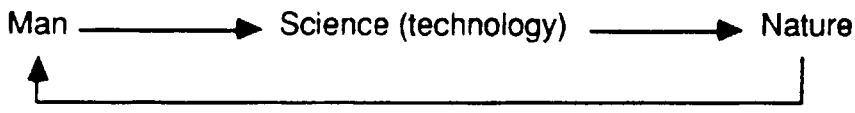
> passes for understanding is really only a description of something that works. (Perrow 1984:85)

Marx, on the other hand, doubtlessly assumed an ever more explanatory and projective force of science when he wrote:

> "Modern industry rent the veil that concealed from men their own social process of production, and that turned the various, spontaneously divided branches of production into so many riddles, not only to outsiders, but even to the initiated." (Capital 1:456)
> The principle which it pursued, of resolving each process into its constituent movements, without any regard to their possible execution by the hand of man, created the new modern science of technology. The varied, apparently unconnected, and petrified forms of the industrial processes now resolved themselves into so many conscious and systematic applications of natural science to the attainment of given useful effects." (Capital 1:456-7, my emph.)

Equally optimistic was his trust in technological possibilities: "Mirabeaus' "Impossible! Ne me dites jamais ce bête de mot!" is particularly applicable to modern technology." (Capital 1:448). He speaks of an ever-increasing productivity of labour together "with the uninterrupted advance of science and technology." (Capital 1:567) At this point in his theory, Marx seems to enlarge his theoretical scheme according to which man transforms nature with the help of technology. Now the role of science becomes crucial. See Fig. 3.1. for a graphical representation:

Fig. 3.1



Here an intriguing question arises: how can we reconcile Marx's statement that technology develops relatively autonomously i.e. independently of science, on the one hand, with his statement, on the other hand, that science will to an ever- greater extent determine the course of technology?

Marx's theory offers two possibilities for such a synthesis. First, we can apply again the distinction between a historical and a critical approach, which in Marx's case is expressed in the difference between an analysis which is "backward-looking" and one which is "forward-looking". The second possibility is contained in his claim that human labour will be able to reappropriate all sorts of objectifications, including modern technology. It is true that a rural idyll is the reference point in the famous passage from the German Ideology (fishing and hunting); but in the same text, Marx also says that the highly-developed productive forces of capitalism will be appropriated by the producers, which is the very precondition for the full development of the individuals (cf. CW 5:86-7 as cited in 3.1.1.). It is important to note that Marx' s basic idea remains the same in this respect, what varies is only the stress he gives to different factors. For example, in the speech to the "People's Paper" (1856), he invokes new-fangled men who would master the new-fangled machinery; in the Grundrisse he envisages a fully-automated production process with

man as mere guardian (see the passage cited below); in Capital he stresses that there will be varied work also under communism, which makes necessary an all-round development of individuals. But the basic idea of the rural model reappears: it is the explicit claim that any fixation of persons to one exclusive task has to be avoided; the all-round development of human capacities and needs is Marx's goal. Regarding the possibilities for the realisation of that goal, Marx's argument is quite optmistic; according to him, it is based on real relations which exist in modern industry. Therefore, the fully developed individuality is both the aim of communism and necessitated by capitalist technology. The rural idyll is replaced by a model where individuals, as it were, switch from one activity to another, but they do this on the basis of a scientific and artistic education (which will also generate new needs in them). This model is no utopia but, according to Marx, inevitable, since modern technology requires it. A functional requirement of modern societies, therefore, leads to the birth of communist man, which is quite an extraordinary claim.

To turn to the scientific dimension, it should be said that Marx analyses technology mainly in its historical development, including its rapid growth under capitalism. He describes this process as an evolutionary process. But it is one thing to state with hindsight a blind evolutionary process, another to state it for the future. And here, I suppose, not only Marx, but no humanist position, could allow for such a possibility. This is why Marx distinguished sharply between pre-history and history proper (cf. 1859 Preface): the first is governed by blind evolution whereas the second is controlled and planned by human purposes. And thhis is the place where sceince becomes most important for Marx. Science provides the means for a planned technology, for a planned Stoffwechsel between man and nature; and, what is more, science

for Marx was not only a desideratum, but a real, unfolding ("before our eyes") force. Under the regime of science, the gap between explanation and evaluation, between blind evolution and conscious human control, between pre-history and history could be bridged.[123] For Marx it is an empirical fact that modern industry (capitalism) already leads mankind to the threshold of history proper. Look at his bold outline in the Grundrisse where he sketches some breathtaking scenarios for a technologically-advanced, communist society:

> Labour no longer appears so much to be included within the production process; rather the human being comes to relate more as watchman and regulator to the production process itself... No longer does the worker insert a modified natural thing [Naturgegenstand] as middle link between the object and himself; rather he inserts the process of nature, transformed into an industrial process, as a means between himself and inorganic nature, mastering it. He steps to the side of the production process instead of being its chief actor. (...) In this transformation, it is neither the direct human labour he himself performs, nor the time during which he works, but rather the appropriation of his own general productive power, his understanding of nature and his mastery over it by virtue of his presence as a social body - it is, in a word, the development of the social individual which appears as the great foundation-stone of production and of wealth. (Grundrisse:704-5)

Marx's optimism with regard to the transparence of technological processes must be subjected to critical examination. It seems that

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123 This general outline seems still to apply to present-day problems of industrial accidents. As Perrow has pointed out, it is due to the poor scientific understanding of existsing technological systems that their working is sometimes dangerous. This view can be contrasted with the standard explanation which assumes perfect functioning of technology and simply blames the operators in case of an accident.

it does not concord with the reality of modern technology. Perrow emphasized four dimensions of technological systems: linear/complex and loose/tight coupled. The point is that Marx excludes the complex dimension form his analysis when stressing that the production process gets "dissected" into its component parts. This suggests that every instrument in the production process serves only one purpose: the production process takes place step by step. However, examples from the chemical and electrical industries indicate that there is also a reverse tendency to observe: parts or components of technical systems are designed so as to fulfil more than one function (cp. Perrow 1984).

To return to the problem of science and technology in Marx. Above, I suggested that we can reconcile the autonomous development of technology and the increasing influence of science in Marx's model with the distinction between historical and critical analysis. But apart from the exegetical task, we are still left with the crucial question: how do we distinguish science from technology and what does their relation look like?

Rosenberg holds that science and technology are essentially two different things which have things in common, but are, in the first place distinct from each other. The difference lies in the specific character of knowledge which is employed. In the case of science we have rules, laws and procedures which can be written down and discussed by the academic profession. In the case of technology, the knowledge which is sometimes employed cannot be explained; technical solutions are found which demand scientific explanation. From this follows that technology cannot simply be conceived as applied science. According to Rosenberg, the main bulk of inventions and technical-practical solutions were found long before a scientific explanation could account for it. "It is still far from unusual for engineers in many industries to develop

a successful solution to a problem for which there is no scientific explanation and for the engineering solution to generate the subsequent scientific rersearch that eventually provides the explanation." (Rosenberg 1982b:144; see also Marx: science depends on the development of trade and industry, cf. CW 5:40)[124].

Price, in a similar vein, says that "the naive picture of technology as applied science simply will not fit all the facts. Inventions do not hang like fruits on a scientific tree" (Price 1982:169). Instead, so he argues, "most technological advances derive immediately from those that precede them... old technology breeds new in just the same way as the scientific process..." (Price 1982:170). Such a characterization would presuppose that technology, like science, could be conceived as a social system (for further discussion see 3.3.). Price bypasses this difficulty in assuming that old technology breeds new, just like old knowledge breeds new,[125] and in endorsing an actor-model in explaining the transfer of knowledge from science to technology.

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124 Heidegger made the same point when he wrote: "It is said that modern technology is something incomparably different from all earlier technologies because it is based on modern physics as an exact science. Meanwhile we have come to understand more clearly that the reverse holds true as well: modern physics, as experimental, is dependent upon technical apparatus and upon progress in the building of apparatus." (Heidegger 1978:295-6) One strand in the sociology of science takes up exactly this point in stressing the hermeneutic character of the natural sciences, see Bloor (1976); Barnes (1977); Mulkay (1979); Knorr-Cetina (1985). For a criticism, see Archer (1987).

125 Cf. also: "One can, I suppose, create technology to order, just by wishing it. But ordinarily one is severely constrained by the old technology's having or not having the capacity to breed a particular desired thing." (de Solla Price 1982:170)

He sees the relationship between the two as an 'interaction' (which takes place between persons) since we know of many cases in which science has passed into technology and technology has made possible new science (cf. Price 1982:171). But the prius is science since he notes a time lag between scientific and technological advance. Price takes an image from Toynbee in order to illustrate the relation between the two. The image is of two dancers, dancing to the same music; it is impossible to tell who is leading, and who following. (Toynbee 1962, vol.1:3; cited in Price 1982:170).

But, "[r]ather than supposing that an outside force affects both dancers, it seems more reasonable to think that their action upon each other keeps them in step." (Price 1982:171) Since the influence is reciprocal, we must assume a complete interaction (cf. id.). However, there is a time-lag between scientific and technological advance which "would seem to indicate that the dancers hold each other at arm's length instead of dancing cheek to cheek. To use the more precise language of the physicist, the relation between science and technology seems to be a weak rather than a strong interaction." (Price 1982:171)

To explain the interaction, Price employs an actor model and stresses the important role of socialisation of the respective actors (i.e. scientists and engineers): "[T]he medium of transmission is the person and the method is the fact of the formal or informal education..." (Price 1982:171) By this mechanism, Price explains the time lag between the two disciplines: it is simply that both, scientists and technologists, during their education, are subjected to some training in the ambient state of the respective other discipline. "It follows then that men on the research fronts of science and technology will be able to use each other's ambient knowledge. It seems too that this will generally

be the ambient knowledge that is on the average about one generation of students old - perhaps ten years." (Price 1982:171)[126]

How hard it is for science and technology to communicate has been expressed by Price in the following way:

> In any case, what commuication difficulty there is seems due to the fact that though the scientists want to write and the technologists want to read, the scientists are writing for their colleagues in science, or sometimes for their imaginary archive; they are simply not writing the sort of material that the technologists want to read. This frustrates the technologists and makes them believe that somewhere in this pile of material, if only they could find it, there is the very valuable material they are looking for to make new products." (Price 1982:173)[127]

In summary, then, there seem to exist few if any channels of communication between science and technology.[128] Rosenberg is aware of this, stressing the distinct character and development of the two. The dancers in this picture are still dancing together, but to different kinds of music! He emphasizes the central role which technology has always played in the history of mankind, thus

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126 Note that this explanation does not depend on an actor model; the same could be said for a systems approach: each system uses informations from its environment i.e. from other systems too.

127 Marx provides an example from hydrauclics in the 18th century: "Hydraulik und Hydrotechnik überhaupt im 18. Jadt. mit vielen Entdeckungen bereichert, grossentheils auch für die Müllerkunst sehr vortheilhaft, die indess sehr langsam, besonders in Teutschland, dem theoretischen Fortschritt folgte... Die Theorie der Wasserräder schwer, daher, als leere Theorie verschien, die Mühlenbauer nahmen wenig Rücksicht darauf." (MEGA II.3.6.:1924)

128 See, also, Stichweh (1987:473), for another example.

clearly referring to Marx's concept of Stoffwechsel (cf. Rosenberg, 1982a:41). He concludes that technology as such can proceed without the guiding or assistance of science. "Indeed, if the human race had been confined to technologies that were understood in a scientific sense, it would have passed from the scene long ago." (Rosenberg 1982b:143)[129]

Technology sets the agenda for scientific research, provides the empirical data without which the latter cannot start. Rosenberg straightforwardly reverses the common view that science is prior to technology: it is technology which "influences scientific activity in numerous and pervasive ways." (1982b:142) In this conception, technology provides empirical data for science just as nature does. To be sure, both science and technology have to do with man's Stoffwechsel with nature; whereas technology is practical-empirical transformation of physical objects, I shall define science as one form of social communication about this process.[130] Science uses the empirical data provided by nature and technology as information on which it builds its own system.[131]

But how can we relate Marx's findings about modern industry to this distinction? Marx emphasizes the important role of science in the modern capitalist production process. Machinery is for him the bodily expression of the abstract principles of science. This is not to say, however, that machinery is the mere application of

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129 Cf. also, his statement that science and technology represent two different forms of knowledge. See Rosenberg (1982a:143), as cited above.

130 Also Marx in the Grundrisse distinguishes a material and a mental dimension of the Soffwechsel, see GR:161 and the distinction implied by Fig. 3.1. above.

131 See 3.4.1. for further elaboration.

scientific knowledge nor to say that science comes before technology. What Marx stresses is the fact that in modern industry scientific knowledge could be applied for the first time in a systematic way and on a large level, and that modern industry gave rise to the expansion and importance of scientific research. Yet, what is more, Marx's stress of the important role played by science is crucial for his communist perspective. Recall the distinction of $nature_1$ and $nature_2$ from chapter 2. It is only under the condition of transforming $nature_1$ into $nature_2$ and understanding this transformation that mankind liberates itself from alien powers. We must thus regard Marx's position as a position which privileges the scientific over the technological dimension, for only a second nature which is understood provides the basis for communist society. It is quite obvious that technologies which are just technical installations and happen to work cannot provide the technological basis for communist society. They cannot provide this basis especially under modern conditions where technologies may affect large parts of the globe and its populations in a detrimental way over a long period of time.

In summary, then, we might say that science and technology are different fields of human activity which are quite distinct as regards their basic characteristics. But they also influence each other, constituting a relationship which is vital for modern industry (see 3.4. for other interrelations). While it is simply not so that technology is "applied science", it is indeed true that some scientific findings get embodied in technical apparatus.

3.1.6. Formal and real subjugation of labour under capital

Marx assumes that every mode of production transforms nature and is forced to produce a surplus product. Historically-modified can

"only" be the form which this product (and hence the performed labour) takes on.[132]

At the beginning of capitalism Marx places a phase called "formal subjugation of labour under capital", which is characterized in the following way:

> "In der That findet sich historisch, daß das Capital, im Beginn seiner Bildung, nicht nur den Arbeitsprozeß überhaupt unter seine Controlle nimmt (unter sich subsumirt), sondern die besondren wirklichen Arbeitsprocesse, wie es sie technologisch fertig vorfindet, und wie sie sich auf Grundlage nicht capitalistischer Productionsverhältnisse entwickelt haben. Den wirklichen Productionsprozeß - die bestimmte Productionsweise findet es vor und subsumirt sie im Anfang nur formell unter sich, ohne etwas an ihrer technologischen Bestimmtheit zu ändern." (MEGA II.3.1.:82)

The mode of production is commodity production, production for exchange value. Labour also has become a commodity but the labour process is not yet fully capitalist. Increase in surplus is reached mainly by extension of the working day (cf. MEGA II.3.6.:2136-7). But this method of production triggers off a development which leads to a new dynamics. Already under conditions of formal subjugation of labour under capital, the specific form of surplus labour leads to
-increase in production,

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132 Cf. MEGA II.3.6.:2136. See, also, Marx to Kugelmann: "Naturgesetze können überhaupt nicht aufgehoben werden. Was sich in historisch verschiednen Zuständen ändern kann, ist nur die Form, worin jene Gesetze sich durchsetzen." (Letter of 11.7.1868) Marx thinks that a socialist society will transform surplus labour into necessary labour, because all labour will be wanted labour: "The aim is to suspend the relation itself [i.e. the capital labour relation, R.G.] so that the surplus product itself appears as necessary." (Grundrisse:612).

-continuity and intensity of labour,

-development of the variation of work ("Arbeitsvermögen")

-differentiation of work

and, finally, a

-relation between worker and capitalist which is based only on exchange and removes all patriarchal and political amalgamations (cf. ibidem).

Real subjugation is characterised by the following:

> "Die capitalistische Productionsweise hat hier bereits die Arbeit in der Substanz ergriffen und verändert. Es ist nicht mehr blos die formelle Subsumtion des Arbeiters unter das Capital; daß er für einen andren arbeitet, unter fremden Commando und fremder Aufsicht... Durch die Verwandlung seines Arbeitsvermögens in die blose Funktion eines Theils des Gesammtmechanismus, dessen Ganzes das Atelier bildet, hat er überhaupt aufgehört, Producent einer Waare zu sein. Er ist nur Produzent einer einseitigen Operation, die nur im Zusammenhang mit dem Ganzen des Mechanismus... überhaupt etwas proucirt." (MEGA II.3.1.:253-4; cf. also id.:82)

With this real subjugation we have, additionally,

-production exclusively for trade (cf. MEGA II.3.6.:21422),and,

-increase in productivity.[133]

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133 "Das positive Resultat hier, daß die Arbeitszeit fällt, deren bedurft wird, um vergrösserte Masse von Lebensmitteln zu produciren, daß dieß Resultat durch die gesellschaftliche Form der Arbeit erreicht wird und daß der Besitz des Einzelnen an den Productionsbedingungen nicht nur als nicht nöthig, sondern als unvereinbar mit dieser Production auf großer Stufenleiter erscheint... Sobald diese gegensätzliche Form wegfällt ergiebt sich also, daß sie [die Arbeiter, R.G.] dies Productionsmittel gesellschaftlich, nicht als Privatindividuen besitzen." (MEGA II.3.6.:2144), my emph.)

Under the regime of formal subjugation of labour under capital the workers are using their instruments (not vice versa, as with the real subjugation), but they produce under one roof, not dispersed (as before manufacture).

> "Bei der formellen Subsumtion der Arbeit unter das Capital erleiden diese Arbeitsbedingungen keine weitere Modifikation; sie bleiben - stofflich betrachtet - Arbeitsmaterial und Arbeitsmittel. Aber bei der neuen Productionsweise, der Revolution in der Productionsweise, die die capitalistische Production schafft, verändert sich die Gestalt dieser Arbeitsbedingungen. Sie erhalten neue Bestimmungen dadurch, daß sie gesellschaftlich zusammenarbeitenden Arbeitern als Bedingungen dienen." (MEGA II.3.6.:2014).[134]

Production now takes place on a large scale because this is economically more efficient (cf. MEGA II.3.6.:2013). But real subjugation, which Marx calls the "new mode of production", (cf. ibidem:2014) combined with machinery, also transforms the working conditions and the work instruments: "Bei der einfachen Cooperation und auf Theilung der Arbeit gegründeten Manufactur erstreckt sich diese Modification blos auf die allgemeinen Arbeitsbedingungen, die gemeinschaftlich benutzt werden können, wie Baulichkeiten etc. Bei dem auf Maschinerie gegründeten mechanischen Atelier ergreift sie das eigentliche Arbeitsinstrument." (MEGA II.3.6.:2014, my emph.).

Marx obviously links his definition of machinery to his concept of real subjugation of labour under capital. Under the conditions of formal subjugation under capital, the labour process is essentially pre-capitalist, that is, workers are wage-labourers

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134 It seems that Marx includes in "Arbeitsbedingungen" (conditions of work) tools and raw materials ("Arbeitsgegenstand und Arbeitsmittel"); see also the treatment in Cohen (1978).

who work under the control, and for the profit, of capital. But the instruments they work with are usually not machines. In both cases, however, the worker is alienated from the means of production: "Wie bei der formellen Subsumtion der Arbeit unter das Capital bleiben diese Bedingungen und daher auch ihre veränderte Gestalt... den Arbeitern fremder Umstand. Bei der Maschinerie geht der Gegensatz oder die Entfremdung sogar... zum feindlichen Widerspruch fort." (MEGA II.3.6.:2014). Marx describes the debasing of the worker under the regime of real subjugation of labour under capital in comparison to the regime of formal subjugation:

> "Diese Specialität der Passivität [An- und Unterordnen unter die Operationen der Bewegungen der Maschine selbst, R.G.], d.h. die Aufhebung der Specialität selbst als Specialität characterisirt die Maschinenarbeit. Die Verbesserungen innerhalb des mechanischen Ateliers selbst darauf gerichtet alle Virtuosität, wieder auf seiner eigenen Basis hervorgewachsen, möglichst zu entfernen. Es ist also ganz einfache Arbeit, d.h. ihre Einförmigkeit, Inhaltslosigkeit und Unterordnung unter die Maschine. Tödtende Arbeit, als Arbeit, die wie bei der Theilung der Arbeit in der Manufactur, völlige Subsumtion des Individuums unter sie erheischt. Sie verhindert die Entwicklung der Specialität, specialisirt aber selbst wieder diese Specialitätslosigkeit. Die letzte Selbstbefriedigung des Arbeiters in der Arbeit fällt hier fort, absolute Gleichgültigkeit, die durch ihre Inhaltslosigkeit selbst bedingt wird... Bei der Manufactur ist die Arbeit continuirlich. Im mechanischen Atelier ist die Aufmerksamkeit auf die Arbeit der Maschine continuirlich, und die durch ihre Bewegungen... bedingte Bewegung des Arbeiters. Sein wirkliches Eingreifen dagegen zufällig, je nachdem die Maschine einen error begangen oder nicht." (MEGA II.3.6.:2021-2).

The domination of machinery over labour power is established whereas in manufacture it was the other way around: "Die Dienstbarkeit unter die Maschine hier also fortwährend, während in

der Manufactur das Instrument stets dienend bleibt." (MEGA II.3.6.:2022). The degradation of the worker, however, does not stop with his being dominated by machinery; moreover s/he gets reduced to an accessory, an appendage of the machine: "Hier die Menschen blos das lebendige Zubehör, die bewußten Anhängsel der bewußtlosen, aber gleichförmig wirkenden Maschinerie." (MEGA II.3.6.:2022)

The specific capitalist way to produce surplus comprises the methods of relative surplus production. Machinery is indispensable here. The products of machinery stand in no relation (compared to earlier modes of production) to the expense of power of the worker[135]. "The production in enormous mass quantities which is posited with machinery destroys every connection of the product with the direct need of the producer..." (Grundrisse:694). For these reasons, amongst others, Marx praises capitalism,[136] and thinks that the revolution in the mode of production[137] and pro-

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135 Cf. Notebook XIX: "Die Masse des Products ... daher in keinem Verhältniß mehr mit der körperlichen Anstrengung des Fusses als bewegender Kraft..." (MEGA II.3.6.:1916)

136 "Ricardo betrachtet mit Recht, für seine Zeit, die capitalistische Productionsweise als die vorteilhafteste für die Production überhaupt; als die vortheilhafteste zur Erzeugung des Reichthums. Er will die Production um der Production halber und dieß ist Recht." This means nothing else "als Entwicklung der menschlichen Productivkräfte, also Entwicklung des Reichtums der menschlichen Natur als Selbstzweck." (MEGA II.3.3.:768, my emph.) Marx praises Ricardo for his "wissenschaftliche Ehrlichkeit", in contrast to Malthus's "Gemeinheit".

137 "In der großen Agricultur, wie in der großen Industrie, sind diese Arbeit und das Eigenthum an den Productionsbedingungen nicht erst zu trennen, sie sind faktisch getrennt, diese Trennung von Eigenthum und Arbeit, die Sismondi beweint, nothwendiger Durchgang zur Verwandlung des Eigenthums an den

...

ductive forces is a necessary historical stage before socialist society. The reason for criticizing capitalism, however is that production for the sake of production does not lead to the development of human productivity but only to the presentation of material wealth [sachlicher Reichtum, R.G.]. This is what is wrong with Ricardo's phrase "production for the sake of production":

> "Andrerseits erscheint daher die Production um der Production willen als ihr grades Gegentheil [because of capitalism's tendency towards overproduction and crises, R.G.]. Nicht Production als Entwicklung der menschlichen Productivität; sondern als Darstellen von sachlichem Reichthum, im Gegensatz zur productiven Entwicklung des menschlichen Individuums." (MEGA II.3.6.:2145) "Das materielle Resultat der capitalistischen Productionsweise... ist die Steigerung der Masse der Producte... Doch nach dieser Seite hin betrachtet stellt sich die capitalistische Production als Herrschaft der Sache über die Person dar." (MEGA II.3.6.:2164)

Under capitalism the production of wealth (1) appears as material wealth which (2) gets in opposition to the producers. Domination of capital over labour in the process of production leads to the enslavement of workers. Marx explicitly claims that this is a consequence both of the economic and technological dimension of production.[138]

...

Productionsbedingungen in gesellschaftliches Eigenthum." (MEGA II.3.6.:2145, my emph.) Thus the fetishism that the producer belongs to the product comes to a standstill and togehter with that, all false representations of the social character of labour. (cf. MEGA II.3.6.:2145)

138 In Capital Marx will retreat from this position and blame only the economic dimension (capitalist use of machinery) for its enslaving effects; see 3.5. for further discussion.

> "Die Subsumtion seiner Arbeit unter das Capital... die im Begriff der capitalistischen Production liegt, erscheint hier als technologisches Factum. Der Frontstein ist fertig. Die todte Arbeit mit Bewegung begabt und die lebendige nur noch als eines ihrer bewußten Organe vorhanden." (MEGA II.3.6.:2057-8, my emph.)

This means nothing else that capitalism's economy, as well as its technology, have escaped human control. The individual -who is still essential to Marx's critical theory - loses his central impact on the explanatory level.[139] Recall figure 2.1., where we had man, technology and nature standing in a relationship. To be sure, Marx will never abandon the thought that human needs are the driving force for the development of the productive forces.[140] But Marx also provides a model which is based on a supra-individual level:

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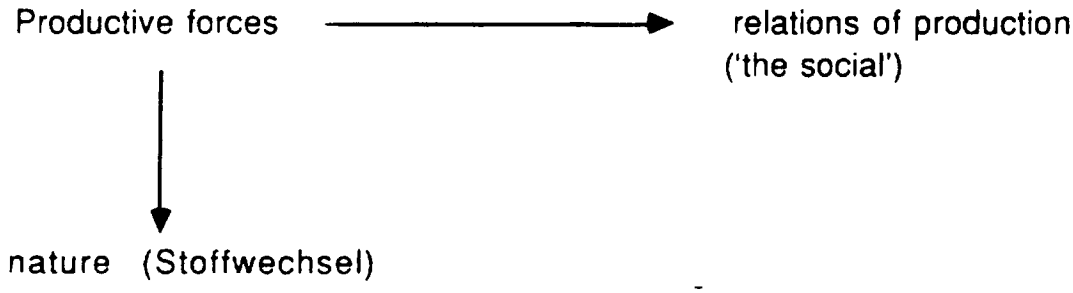
139 Habermas is thus mistaken when he claims that "Marx did not reckon with the possible emergence at every level of a discrepancy between scientific control of the material conditions of life and a democratic decision-making process..." (Habermas 1971:58) Rather, Marx in his preparatory writings for Capital (above all in his 1861-3 Manuscripts) can be seen as a forerunner of Freyer and Schelsky, who, according to Habermas, have developed a counter-model which recognizes technology as an independent force.

140 As he put it with respect to machine technology: "Unmittelbar wird die Maschinenarbeit als revolutionierendes Element ins Leben gerufen durch den Überschuß des Bedürfnisses über die Möglichkeit, ihn mit den alten Produktionsmitteln zu befriedigen..." (MEGA II.3.6.:1973)

Fig. 3.2



Behind 'the social' we again have relations between man and man; behind the Stoffwechsel we again have relations between man and nature. The three parts of the figure can be conceived as being in a process of coevolution which is to say that productive forces, nature and social relations develop together. This model constitutes a mode of production, i.e. a double relation between man and man (the social) and between men and nature (Stoffwechsel).[141] On the basis of this model, an evolutionary approach seems to spring up naturally. Therefore, I will focus in the remainder of this chapter (and in chapter 4), on the coevolution of productive forces and social relations. Suffice it here to say that for Marx there was a development of technology from simple tools to complex machinery; likewise, social forms developed from simple ("transparent") to complex forms. His hope

141 With respect to ancient societies, Marx formulated this connection in the following way: "Those ancient social organisms of production... can arise and exist only when the development of the productive power of labour has not risen beyond a low stage, and when, therefore, the social relations within the sphere of material life, between man and man, and between man and Nature, are correspondingly narrow." (Capital 1:83-4)

was that communism would bring about simple social forms on the basis of complex technology - a question which will be further pursued in chapter 5.

3.1.7. Progress?

We can distinguish several criteria for measuring progress. There are economic criteria, regarding productivity or per capita income. Productivity is usually defined as the relation between costs and benefits, between investments and payoffs. Higher productivity thus means to achieve the same output with less investment, or, which is the same, to achieve more output with the same amount of investment.[142] Another criterion would be a technological one which is purely immanent to technology and which judges technological features like reliability, speed, longevity, energy input etc. Still another criterion would be spiritual in that it asks if people are freer or happier in comparison to former states in history.

Apart from the economic criterion, the latter two seem to cause difficulties. For how can we distinguish different levels or stages of evolution in the technological or ethical realm? And, more penetratingly, is progress involved in this development? With Weick we could say again: all depends on which criteria we want to use. There are no absolute standards regarding technical criteria: they are all dependent on a social-cultural-economic context. A

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142 Marx is not precise when he writes that "the growth of the productive forces of labour means merely that less direct labor is recquired in order to make a larger product" (Grundrisse:831, see also MEGA II.3.6.:2144, as cited below), since it is sufficient that the same product is produced with less labour.

technology which comes later in time need not be "superior" to a previous technology (see Rammert 1988).

Let us, therefore, look for a moment at spiritual criteria in judging progress. In a very stimulating book on Goethe's Faust, Binswanger (1982) pointed out that along with modern economic growth, mankind witnessed two major losses: beauty and (technical and economic) security.[143] If we now contrast the purely economic and technical criteria with the spiritual criteria, we can conclude that the overall development need not establish an unequivocal progress. Marx's criteria, in fact, were not only economic and technical, but also spiritual.[144] For Marx, real wealth is not only, or primarily, expressed in value or material goods, but in total individuals. Neither does Marx neglect the physical aspect of material production. Again, unlike the economists, he does take into account qualitative criteria (so when he praises the Ancient world for caring most about the quality of the products), he does stress the need to transform nature with respect to the well-being of individuals. Both points make clear that the charge against standard economics of neglecting the natural environment cannot be made against Marx. On the contrary, even today his theory offers a framework which is

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143 Binswanger distinguishes the latter again into "risk" and "worry" (Sorge), cf. Binswanger (1985:65-70).

144 Cohen, for example, stresses only the economic criteria when he writes: "The United States can produce, much more abundantly per head, everything the medievals could produce, and more besides, with the exception of certain products perhaps wholly beyond its reach, such as, say, stained glass of the kind found on Notre Dame Cathedral... The concept of need is not easy to handle, but it would be hard to maintain that the unavailability of just that kind of stained glass generates an overwhelming frustration." (Cohen 1978:60) But these are issues at stake when we discuss the question of progress - in this case, a loss of beauty.

capable of incorporating ecological problems and developing criteria to solve them. It thus offers a political and philosophical framework to deal with the problem in a rational way, avoiding irrationalist evasions or the call for a "new ethics".

It is common in interpretation to neglect the latter element in Marx. Thus, the following critique of Luhmann is misconceived. He charges Marx (and Durkheim) for employing an "evolutionist" position, since they used the notion of "division of labour": "In jedem Falle macht dieser Theorieansatz [i.e. division of labour, R.G] eine Art Fortschrittskonzeption der historischen Entwicklung, Marx und Durkheim eingeschlossen, fast unvermeidbar." (Luhmann 1984b:320). Ironically, Luhmann's charge backfires: with the same legitimation we could charge him with being committed to a strong notion of progress because he employs the concepts of "functional differentiation" and "increase in complexity". Similarly, one could charge him with claiming that the more comlexity we have in society, the more progress exists. As Luhmann himself says, evolutionary processes are developments which display some succession of order to an observer. This means that it is the observer's criteria of order which are crucial here. The evaluation of this process is equally observer-dependent. If, for example, an observer labels an evolutionary process as "progress", he has to show the criteria for doing so. Darwinian theory is not usually committed to any notion of progress whereas Marxist social theory definitely is. However, Marx did present his normative assumptions. In the Manuscripts (1861-3), Marx shares sides with Ricardo against Sismondi, defending the former's appraisal of "production for the sake of production":

> "Ricardo betrachtet mit Recht, für seine Zeit, die capitalistische Productionsweise als die vortheilhafteste für die Production überhaupt; als die vortheilhafteste zur Erzeugung des

> Reichthums. Er will die Production der Production halber und dieß ist Recht. Wollte man behaupten, wie es sentimentale Gegner Ricardo's gethan haben, daß die Production nicht als solche der Zweck sei, so vergißt man daß Production um der Production halber nichts heißt als Entwicklung der menschlichen Productivkräfte, also Entwicklung des Reichthums der menschlichen Natur als Selbstzweck." (MEGA II.3.3.:768)

Marx praises Ricardo's scientific honesty; nevertheless, Marx distinguishes himself also in this respect from Ricardo. Consider the following quote from the same page of the MEGA:

> "Die Rücksichtslosigkeit Ricardo's war also nicht nur wissenschaftlich ehrlich, sondern wissenschaftlich geboten für seinen Standpunkt. Es ist ihm aber deßhalb auch ganz gleichgültig ob die Fortentwicklung der Productivkräfte Grundeigenthum todtschlägt oder Arbeiter. Wenn dieser Fortschritt das Capital der industriellen Bourgeoisie entwerthet, ist es ihm ebenso willkommen... was liegt dran, sagt Ricardo. Die Productivität der menschlichen Arbeit hat sich verdoppelt." (MEGA II.3.3.:768)[145]

But Marx does not say "who cares?" when workers are crushed in the factories. Rather, his analyses were "fired by outrage and indignation and the burning desire for a better world" (Lukes 1985:3). Neither does Marx content himself with an increase in material wealth since this wealth assumes antagonistic forms vis-a-vis the producers, as is demonstrated in the following passage:

> "Das materielle Resultat der capitalistischen Production... ist die Steigerung der Masse der Producte... Doch nach dieser Seite hin betrachtet stellt sich die capitalistische Production als Herrschaft der Sache über die

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145 But cf. Marx's judgement of Malthus on the preceeding page, MEGA II.3.3.:767.

> Person dar. Denn die Creation der Gebrauchswerthe in steigendem Umfang, Qualität, Mannigfaltigkeit... erscheint als der Zweck für den die Arbeitsvermögen nur Mittel sind, der nur durch ihre eigene Vereinseitigung und Entmenschlichung erreicht wird." (MEGA II.3.6.:2164-5).

3.2. Evolutionary approaches to technology in economic theory

A recent strand in economic theory, especially Neo-Schumpeterian economics, conceives technology in an evolutionary way. In the following section, I shall therefore discuss an evolutionary approach to technology and, only after that, several objections against it. The criticisms can be divided into three main strands. The first criticism sees the danger of technological determinism when endorsing an evolutionary approach to technology. The second criticism doubts if the analogy to Darwinism is legitimate or even feasible. The third criticism doubts if the distinction between system and environment can be made and asks how the system itself has to be conceptualized. The remainder of this section, the following 3.3. and 3.4., deal with these problems.

3.2.1. The behavioural theory of the firm

Criticizing neoclassical economics, Nelson and Winter claimed that existing technologies were not chosen because they were indicated by market signals or followed from the rational decision of a firm in order to maximize its profits. On the contrary, so they argued, the technology of a firm is the outcome of a routine; firms do not choose technologies, but have them. In their words:

> Our principal break with neoclassical tradition lies in our 'behavorial' treatment of the question: why is the firm at any time using the technique it is using? A neoclassical

> answer would be that the firm has chosen its technique on the basis of profitability calculations comparing the elements of a large choice set (production function). A behavorialist's answer, and the one employed in our model, is of a very different form. The production technique used by a firm at any time is regarded as a complex pattern of routinized behavior, of which the input-output coefficients are a quantifiable aspect. The firm is not seen, at any time, "choosing" its technique from a large choice set, but rather as "having" its technique." (Nelson and Winter, 1976:94)

The point Nelson and Winter are making here is that they reject the idea that technologies are simply chosen because of their profitability. Rather, firms are developing rules and meta-rules for the development and selection of technologies. This "evolutionary" approach to technology has been a very influential one in the recent debate among economics, economic historians and also among sociologists.

The approach contains, however, several points which proved to be problematic for scholars working on the basis of it. They focused mainly on the question whether technology has "inner logic" or "trajectory". This set of questions is closely related to the methodological question of Darwinian evolutionary theory.

Dosi, building upon the evolutionary approach of Nelson and Winter, made the explicit analogy to Darwinian theory. Although he does not develop a full analogy to Darwinian theory, we can conclude that Dosi equates specific technologies with "species", and the environment with economy and society (see Dosi 1984:20). Now, Dosi holds that the environment does not only select among mutations, but is also selecting the direction of mutations.

> [T]he economic and social environment affects technological development in two ways, first selecting the 'direction of mutatation' (i.e.

> selecting the technological paradigm) and then selecting among mutations, in a more Darwinian fashion (i.e. the ex-post selection among Schumpeterian trials and errors)." (Dosi 1984:20)

But what exactly does the environment constitute? Dosi stresses three factors: the economy, politics and institutions. Since there are many possible technologies which could be chosen, it is "hardly possible to compare and rank them ex ante" (Dosi 1984:18). This is witnessed by the "role often played in the establishment of a particular technological trajectory by public ('political') forces" (Dosi 1984:18). As examples, Dosi mentions the military and space programs in the US and the synthetic chemistry in Germany which emerged in the post-Bismarck period out of that country's drive towards self-sufficiency. [146] Also 'bridging institutions' between 'pure' science and applied R&D are of great importance here. But these three environmental factors do not shape a technological trajectory: technology is still underdetermined. As Dosi observes, "competition does not only occur between the 'new' technology and the 'old' ones which it tends to substitute, but also among alternative 'new' technological approaches." (Dosi 1984:19)[147]. These remarks, however, indicate that techno-

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146 Cf. Dosi (1984:18). Comparing the role of policies with respect to automotive and aircraft technology, another author states: "In one important respect the development of commercial aircraft and aircraft engines was different from the development of automotive technology. In the case of the automobile the government played no significant role. But government support for the development of military aircraft and aircraft engines generated technology applicable to commercial aircraft." (Klein 1977:109)

147 As I shall propose later, the environmental factors economy, politics and science can be viewed as systems themselves. Technology in this conception is seen as an emergent phenomenon which arises out of the interacting of these

logy cannot be shown to have a real autonomy, to be a real unity which evolves. Rather, it has to be conceptualized as having an apparent autonomy but essentially dependent on social factors.[148]

Dosi not only uses the analogy to biology in explaining technological trajectories but also an analogy to the philosophy of science, especially to Kuhn's concept of "paradigms". This was already hinted at with Nelson's and Winter's approach when they alluded to Kuhn's aperçu "You can't beat something with nothing", which means that a new scientific paradigm must be able to replace the old one: it is not sufficient to prove the flaws of an established paradigm, if there is no conception which could take its place. Dosi applies this line of thought to technology itself.

> "In broad analogy with the Kuhnian definition of a 'scientific paradigm', we shall define a 'technological paradigm' as a 'model' and a 'pattern' of solution of selected technological problems, based on selected principles derived from natural sciences and on selected material technologies... We will define a technological trajectory as the pattern of

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...

three systems. Dosi comes close to a similar statement when he writes that the "emergence of radically new technological paradigms ... stems from the complex interplay ... between advances in science, institutional factors and economic mechanisms." (Dosi 1984:292) It follows from this view that technology is a "dependent variable" and thus has only an apparent evolution; in reality, it is a product of social evolution.

148 Rammert reports on a study by Gilfillan who stressed the self-referentiality of technical development. This means that engineers take as a starting point of their activity inventions, products and hand-books from their colleagues. In my view, this is not sufficient to ascribe an autonomy to technology. It would only suffice to derive a stagnant line of development since these practices would repeat and imitate each other rather than invent something new.

> 'normal' problem-solving activity (i.e. of 'progress') on the grounds of a technological paradigm." (Dosi 1984:14-5).

Dosi offers us a criterion of progress which is immanent to technology itself: problem-solving activities arise within a given technological paradigm and around 'focusing devices'. If they succeed, this could be an instance of 'progress'.[149] But what if we compare different technological trajectories? In this case, the answer seems not very clear at all; not even evolutionary theory has a ready-made answer to it.[150] As we shall see, Marx distinguishes in a more general manner between different ("epochal") technologies ("technological trajectories"). According to him, there are three big historical forms: (1) artisan, (2) manufacture, and (3) machines. Each one stands for a specific historical epoch, it is the material base for every social organization (cf. Capital 1:352 fn). For Marx, the transition from (1) to (2) and from (2) to (3) was paralleled by an increase in productivity, and, to a certain degree, by "progress". His notion of progress, however, is neither purely economic nor purely technological; it also contains an ethical component.[151]

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149 However, the difference between progress and problem-solving activities should be kept in mind. If problem-solving activities succeed, there may be progress in the short run or on the micro-level; from an observer's viewpoint, and/or from the historian's viewpoint, this need not not be true. Moreover, it is not said that this "progress" is a linear, directional process. It could also be a development on a circular, or any other, line.

150 See again Darwin's refusal to equate evolution with progress, Gould (1973:36).

151 Cf. Marx's judgement of Ricardo, above. See chapter 4 for further discussion.

3.3. Technology as a social system?

At this point it may be useful to state again my own position with respect to technology. In my view, technology is (1) a social-material entity which (2) can undergo evolutionary processes but (3) has no autonomy and therefore cannot be conceived as a social system. Since (1) and (2) have been elaborated above, I shall draw attention here mainly to (3).

Consider, first, two important distinctions which we encountered above. One is the distinction between science and technology, the other is the distinction between system and environment. I shall claim that science,[152] but not technology, can be conceived as a social system. The difference can be described as follows: the first is a homogenous, well-defined field in which actions or communications are the basic units and in which meaning is transmitted; the second is a heterogenous field which has to do primarily with the physical reordering of the world.[153]

In a recent article, Renate Mayntz emphasized the difference between social systems and socio-technical systems. According to her, technological systems cannot be analysed as functional subsystems of society because the components of technological systems are not (only) social.[154] Instead, goes her claim, in

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152 And not only science, as we shall see later.

153 To avoid a possible misunderstanding: in denying the status of a social system to technology, one does not deny the decisive role of technology in modern societies.

154 Or, in Habermas' earlier defintion: "[W]e shall understand "technology" to mean scientifically rationalized control of objectified processes. It refers to the system in which research and technology are coupled with feedback from the economy and administration." (Habermas 1971b:57)

analysing socio-technical systems, one should leave the ground of the theory of social differentiation and conceive technological systems (such as large infrastructural technologies) as socio-technical systems (Mayntz 1988:236). This approach rightly proposes that technology cannot be conceived as a social system. However, the consequence which is drawn does not accomodate the abstract level on which my discussion is here located. Mayntz aims at a theoretical framework which illuminates empirical studies of specific technological infrastructure systems; my analysis tries to analyze relations between technological and social factors per se.

Several authors have emphasized the similarity between science and technology. One similarity is that both employ a method of decomposing (analysing) and recombining (see Price 1982). While this is obviously true, there is also a big difference. Consider the cases of a scientist and an engineer. The engineer will apply the scientific knowledge which he has been learning (his "ambient knowledge" in the language of Price); but when it comes to the point where he has to solve a practical problem, he does not proceed in an essentially scientific way. It is not that intuition plays a greater role here than in science; rather, it is the fact that engineers can rest content with solutions they find without asking for the exact scientific explanation. Both scientific and technological activities are problem-solving, decomposing and recombining, but the engineer is concerned with a practical, workable solution whereas the scientist is looking for explanations on the level of his academic discipline. In the words of Price, science produces papers, technology machines, drugs, products of any sort (cf. Price 1982:170).

Consider now the distinction between system and environment. Technology not only stands in a close relationship to science, but

also to economy and politics.[155] Technology should be seen as part of the material world which has already been transformed by social labour into tools, instruments, machines.[156] Technology contains a material and a social element, matter and mind. In Marx's formulation: "Nature builds no machines, no locomotives, railways, electric telegraphs, self-acting mules etc. These are products of human industry; natural material transformed into organs of the human will over nature, or of human participation in nature. They are organs of the human brain, created by the human hand; the power of knowledge, obejectified." (Grundrisse:706).

Scheler stressed that in modern societies science and economy are both autonomous social spheres: capitalist economy is driven towards limitless "Erwerben (als actus), nicht zum Erwerb (als wachsendem Sachbesitz)..." (Scheler 1980:129) Likewise, science is expanding in a similar unlimited way: "Auch die moderne Wissenschaft verwaltet weder einen gegebenen stabilen Wahrheitsbesitz, noch forscht sie nur um Lösung bestimmter, durch Bedürfnisse gestellter Aufgaben willen, sondern sie ist primär ein Wille zu 'Methoden', aus denen... in grenzenloser Weise in einem unbegrenzten Prozesse immer neues materielles Wissen arbeitsteilig - fast wie von selbst - hevorgeht." (ibidem).

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155 See Scheler (1980) for a model of a triple selection made by the scientist, the engineer and the entrepreneur to which I want to add the political element. The scientist wants to construct all possible machines, the engineer all workable machines, the entrepreneur all profitable machines and the politician all machines which enhance power and legitimation.

156 Marx presuppcses "Naturstoff" which is transformed with the help of technology which is already transformed "Naturstoff", see MEW 3:45.

For my subject, a third social subsystem is relevant. This is politics. There have been some doubts whether politics deserves a special treatment within the social sciences. John Stuart Mill argued that there can be no such special science, since "[t]hose phenomena... with which the influences of the ethological state of the people are mixed up at every step (so that the connexion of effects and causes cannot be even rudely marked out without taking those influences into consideration) could not with any advantage... be treated independently of political ethology..." (Mill 1974:906). This argument that politics cannot be studied separately since it is mixed up with the national character at every step is not very convincing, because the argument is not particular to politics - the same can apply to economics, too, for example: there are undoubtedly certain nationalities who can be said to have a greater business spirit than others. In contrast to Mill, Max Weber holds that modern politics in fact forms a separate field of human action which can be studied accordingly. In Politik als Beruf, Weber, quite similar to Scheler, starts from an analogy to the economy as studied by Karl Marx. Both emphasize the analogy, but also that the respective fields are following quite unique laws of their own.[157] Above, we saw how Scheler defined the specific function of science in modern societies. Now, how does Weber define politics? According to him, "engage in politics" means nothing else than "to seek to influence the distribution of power within and between political structures." (Weber 1948:83) How is this political realm defined? Weber writes:

> "Everywhere the development of the modern state is initiated through the action of the prince. He paves the way for the expropriation

157 Weber says: "The direction of capitalist enterprises, despite far-reaching analogies, follows quite different laws than those of political adminstration." Weber (1948:82)

> of the autonomous and 'private' bearers of executive power who stand beside him, of those who in their own right possess the means of administration, warfare, and financial organization, as well as politically usable goods of all sorts. The whole process is a complete parallel to the development of the capitalist enterprise through gradual expropriation of the independent producers. In the end, the modern state controls the total means of political organization, which actually come together under a single head. No single official personally owns the money he pays out, or the buildings, stores, tools, and war machines he controls. In the contemporary 'state' - and this is essential for the concept state - the 'separation' of the administrative staff, of the administrative officials, and of the workers from the material means of administrative organization is completed." (Weber 1948:82)

Although sketched very roughly, these systemic distinctions are the ground on which later versions of social theory could find a point of departure for their functional and systemic approaches. In what follows, I shall take Luhmann's theory as a major reference point when discussing the differentiation of society into subsystems, and the interrelations between them. In his theory, politics is that functional subsystem of society in which collectively binding decisions are taken.[158]

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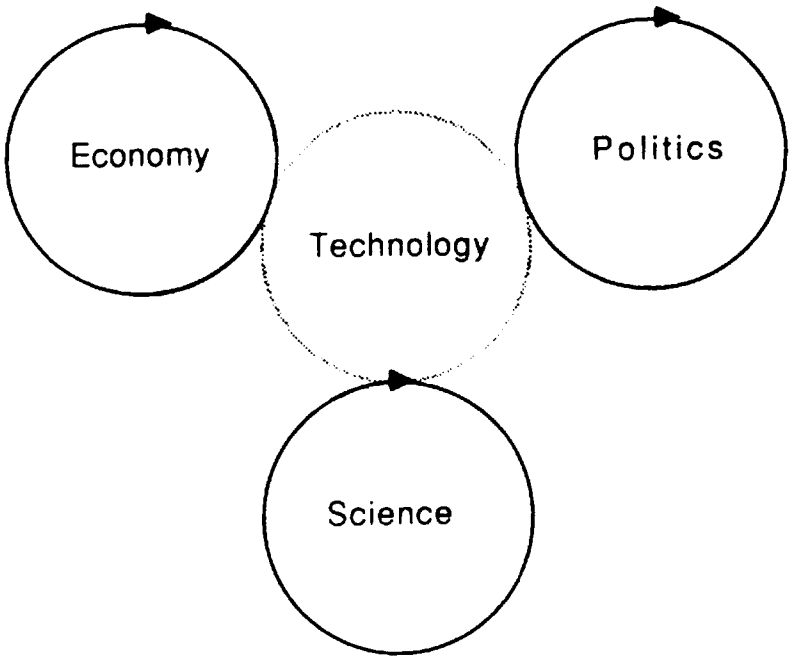
158 Early versions of systems theory saw the political system as closely connected to the legal system and sometimes actually conceived them to be inseparable. For example, Karl Deutsch suggested conceiving of only one legal-political system. (Deutsch 1963) Luhmann objected to this view quite rightly that "solange man mit einer Systemtheorie arbeitete, die auf verdichtete Interdependenzen im Vergleich zu gelockerten Interdependenzen im Verhältnis zur Umwelt abstellte, war in der Tat nur ein System zu sehen. Diese Theorie muß jedoch einen unabhängigen Beobachter voraussetzen, der diese Interdependenzen 'objektiv' feststellt. Einen solchen

As we shall see in a moment, the most convincing solution to the problem of distinguishing system and environment is to attribute everything which is not part of the system to the environment. Thus each of these systems conceives all other systems and the environment (such as technology and natural resources) as its environment. Note that economy, politics or science have to take into consideration the characteristics of existing technology. This may influence the systemic behaviour in many ways. Consider: politics is confronted with dangerous technologies as a problem of legitimation; economy which is keen on certain most profitable technologies; scientific research is dependent on technological apparatus and research funds.

Fig. 3.3



...

Beobachter gibt es nicht. Alles Beobachten erfolgt durch Beobachter, die ihrerseits empirische, also konditionierte, also beobachtbare Systeme sind..." (Luhmann 1988c:4).

Usually the production of technology itself is conceived of as an economic activity, i.e. firms are concerned with the construction of new technologies. On this view, technology is interpreted in a E-T matrix where firms develop technology in their R&D departments or buy them from other firms. Economic activity is seen as including technological activities, or, to put it the other way round, technology is a special case of economic activity.[159] Although this is a rather crude and narrow version of the social dimension of technology, it may serve the purpose to illustrate a "technological trajectory". A reason for such a "technological trajectory" is the role of fixed capital. As Hughes put it,

> "The durability of artifacts and of knowledge in a system suggests the notion of trajectory, a physical metaphor similar to momentum. Modern capital-intensive systems possess a multitude of durable physical artifacts. Laying off workers in labour-intensive systems reduces momentum, but capital-intensive systems cannot lay off capital and interest payments on machinery and processes. Durable physical artifacts project into the future the socially constructed characteristics acquired in the past when they were designed." (Hughes 1987:77)

Consider now the enlarged view: here we have scientific, economic and political factors shaping technology. Additionally, a new technology must be a technology which fulfils certain standards of engineering. A new technology thus has to pass four "filters": politics, science, economics and engineering. Since this interplay

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159 As Max Adler (1964:32) put it: "Wirtschaft und Technik sind gar nicht zwei verschiedene Faktoren, die aufeinander wirken könnten, sondern sie sind nur zwei Seiten eines und desselben Prozesses, des gesellschaftlichen Lebens- und Arbeitsprozesses..."

takes time, we have to reckon with a certain inertia of technological development; it is unlikely that all the time technologically revolutionary "shocks" occur. Quite on the contrary, it is likely that a process of diffusion and saturation occurs.[160]

Piore and Sabel try to explain both technological trajectories and historical turning points. Their "possible worlds approach"[161] may be seen as akin to the "social construction of technology" approach when they stress that there is no "absolute best technology": "Thus although the winning design had to meet some minimum performance standard, the sweep of its success was not a proof of unrivaled technical superiority, nor of the existence of a narrow track of progress: other variants could have served as well. Power in the market, not efficiency (in the sense of a uniquely appropriate application of technology) decided the contest." (Piore and Sabel 1984:40) Once a breakthrough has been made, many competitors choose to follow a proven approach "rather than risk failing to find one more suited to their needs." (ibidem) From this the authors conclude that "in the world of possible worlds, relatively short periods of technological diversification punctuate longer periods of uniformity. The technical knowledge that is accumulated during the interludes of diversity creates the possibility of divergent breakthroughs: branching points. At these technological divides, the different political circumstances in different regional or national economies moves technology down correspondingly different paths." (Piore and Sabel 1984:39) Thus they suggest the

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160 Economists call this "absorbing Markov processes". I shall return in ch.4 to the problem of "stasis".

161 This approch has been developed by Stalnaker and Lewis (and before them, of course, by Leibnitz). For a good discussion of the theory with respect to economic history, see Elster (1978). See also the critical remarks by Lukes (1980).

> "I would interpret the Marxian position to be that it is the changing requirements of industry and the altering perception of economic needs which provide the stimulus to the pursuit of specific forms of scientific knowledge. But I would also conclude that the Marxian position cannot be adequately described as a demand-induced approach without doing a severe injustice to the subtelty of Marx's historical analysis. For the ability to apply science to the productive sphere turn upon industry's changing capacity to utilize such knowledge... Nor did Marx argue that the historical sequence in which scientific disciplines actually developed was also determined by economic needs... This strongly suggests at least some degree of independence and autonomy on the part of science in shaping the sequence of industrial change..." (Rosenberg 1976b:135-6; see also Capital 1:434, 567).

3.3.1. Criticisms: System and environment

In contrast to the above-mentioned model of a "technological trajectory", several authors have developed a different approach. Pinch and Bijker (1987) speak of a "multidirectional development of technology"; Callon (1987) assumes an "actor-network" which contains animate and non-animate components; Law (1987) in a similar vein, coins the notion of "heterogenuous engineering"; van den Belt and Rip (1987) assume a "nexus" between technological trajectory and the selection environment (which they see embodied in patent law in an exemplary way). All these concepts try to avoid what the authors think to be an inherent difficulty of evolutionary theory: the distinction between system and

environment.[165] As Callon rightly states: "The systems concept presupposes that a distinction can be made between the system itself and its environment."[166] (Callon 1987:100). But "how do we define the limits of a system and explain concretely the influence of the environment?" (Callon 1987:100) The main difference to Darwinian systems is seen in the fact that in the case of technology the selecting criteria are not just given, but socially-shaped. Van den Belt and Rip make this point following Elster (1984:6): "In biological evolution, although mutations are random, the selection process is deterministic; that is there are 'well defined criteria for accepting or rejecting any given mutation.' (Elster). In societal evolution involving technological development, even the selection process is far from deterministic: Intentions and expectations play a role..." (van den Belt and Rip 1987:140-1) In other words: actors try to change the actions of others and thereby change their environments. "Thus the assumption of a selection environment that is truly independent of a particular technological trajectory is hard to justify." (id.) Against this argument three points can be made[167] :

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165 From this basic assumption follow the different attempts to resolve the problem: whether "nexus", "actor-network" or "heterogenous engineering", all try to dissolve the boundaries between system and environment.

166 The theoretical problems which the authors pose themselves thus arise from a misconception of technology: only if one tries to define technology as a social system, does the difficulty of distinguishing system and environment arise. Yet another consequence follows from some of their approaches: those who think that technology cannot be regarded as a social system seem to reject systems theory tout court (Mayntz is an exception in this respect).

167 As I pointed out in 3.1.2., there is an important difference between biological evolution on the one hand and social and technological evolution on the other. This difference lies

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First, if we take into account unintended consequences of human action, we cannot assume strategic action to be always successful (see Douglas 1986). In this case we again get blind events, which can be studied from an observer's standpoint with the help of evolutionary models.

Second, there are inherently technical factors which determine a special course of development in some cases. We can illustrate this point again with an example from biology. As Gould has pointed out, "Galileo argued that the bone of a large animal must thicken disproportionally to provide the same relative strength as the slender bone of a small creature... This simple principle of differentiatal scaling with increasing size may well be the most important determinant of organic shape. J.B.S. Haldane once wrote that 'comparative anatomy is largely the story of the struggle to increase surface in proportion to volume'. Yet its generality extends beyond life, for the geometry of space contains ships, buildings, and machines, as well as animals." (Gould 1973:173-5). Gould then presents medieval churches as a testing ground for the effects of size and shape. There are inherent barriers for the size of a church, because

> "the area of outer walls and windows would increase as length cubed. In other words, the area of the windows would increase far more

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...

in the different speed of development and the higher capacity of the social field in recombining its elements in innumerable ways. Evolution of biological species is a relatively slow process which leads to specialisation of natural characteristics. Evolution of social forms and of technologies is a relatively fast process of differentiation and recombination of its elements. The last aspect thus deserves our special attention (see Luhmann 1984a:569; Tiezzi 1985; and see chapter 5).

> slowly than the volume that requires illumination... Large organisms, like large churches, have very few options open to them. Above a certain size, large terrestrial animals look basically alike - they have thick legs and relatively short, stout bodies. Large medieval churches are relatively long and have abundant outpunchings. The 'invention' of internal organs allowed animals to retain the highly successful shape of a simple exterior enclosing a large internal volume; the invention of internal lighting and structural steel has permitted modern architects to design large buildings of essentially cubic form. The limits are expanded, but the laws still operate." (Gould 1973:175-7)[168] .

This may be an illuminating illustration when discussing the question of technological autonomy or technological trajectories. A small car probably cannot be a large car writ small; neither can the opposite obtain. In ignoring this, the Ford motor company had to make an unpleasant experience:

> The troubles that the Ford Motor Car Company had in the 1930s producing a compact car suggest that some of their problems resulted from the fact that they presumed small cars are made the same way as large cars: take a big car and shrink it. Since Ford knew how to make large cars, they thought there was no problem..." (Weick 1979:6)

But even if technology develops in accordance with the laws of size and shape, it eventually arrives at a halting point. To advance technology, new technological solutions must be available. We may apply this insight to other dimensions as well, such as reliability, life-span, energy-balance of technical artifacts. In

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168 As a schoolboy, I was always struck by the example that there are limits in length for a rope which is hanging freely. At a certain length it will inevitably break, because it cannot bear its own weight.

so doing, we can derive a dynamic model of technical change in which periods of simple extension alter with periods of technical revolutions. The first phase is characterised by extending existing technical principles (such as: bigger, smaller, faster, slower, lighter, heavier, more silent, more powerful etc., see Rammert 1988). The second phase is characterised by a technical invention which helps to overcome a restriction, an obstacle to further development. There are several theoretical formulations of this problem, such as Hughes' "reverse salients", or Rosenbergs "bottlenecks". Furthermore, there seems to exist an equivalent on the economic level in the decrease of returns ("Grenznutzen") or in absorbing Markov processes: in these cases a point of saturation is reached, beyond which no further investment is optimal.

Third, all the approaches discussed above have one basic flaw in common: it is their anthropomorphic model of social action and evolution. Only by placing human action ('individuals') in the centre of analysis do they arrive at their conclusions. MacKenzie most clearly expresses this (mistaken) view when he writes: "[A]ctors create and maintain systems, and if they fail to do so, the systems in question cease to exist." (MacKenzie 1987:197) And Hughes, on whom MacKenzie builds his argument, takes the same view in stressing the actor-dependent characteristics of technological systems: "Because they are invented and developed by system builders and their associates, the components of technological systems are socially constructed artifacts." (Hughes 1987:52). For this reason, "the convention of designating social factors as the environment, or context, of a technological system should be avoided." (Hughes 1987:52) But what if we reverse the two? Could we not imagine technology as part of the environment of social systems? I think this is the solution to the problem which, however, the authors under discussion here cannot allow for. Instead

of treating technology as the environment of social systems, the heroic actions of individual "system builders" must fulfil the theoretical blank in the analysis of technology.

Before going into greater detail on the questions of evolution and systems theory (chapter 4), I shall keep attention for the remainder of this chapter on Marx's own analysis. Next I shall discuss Marx's alleged technological determinism (3.4.), the question of technological alienation (3.5.) and the division of labour (3.6.).

3.4. Marx - a technological determinist?

Discussing the question of technological determinism in Marx, we should first of all devote some attention to the problem of determinism in Marx per se.

Marx is often interpreted as an economic determinist. This interpretation holds that Marx's 'iron laws of history' rest on the paramount role of economic motives for social development. From the German Ideology where he sets up his research programme of investigating into the "life-process of the real individuals" (CW 5:35) to his later Critique of Political Economy he is obsessed with the important role economic factors play in social life. A very clear expression of this view is the all-too-famous "base-superstructure" metaphor. According to this model, it is clear that the economic base is far more important than the political, juridical or cultural superstructure:

> "In the social production of their life, men enter into definite relations that are indispensable and independent of their will, relations of production which correspond to a definite stage of development of their material

> productive forces. The sum total of these relations of production constitutes the economic structure of society, the real basis, on which rises a legal and political superstructure, and to which correspond definite forms of social consciousness. The mode of production of material life conditions the social, political and intellectual life process in general. It is not the consciousness of men that determines their being, but, on the contrary, their social being that determines their consciousness." (CW 29:263).

Nevertheless,[169] Marx was also a social determinist. This is to say that his main interest in explaining historical change was in social institutions. This is already indicated by the last sentence in the above-quoted passage from the 1859 Preface. In so doing, he did not concentrate on individual behaviour nor on economic relations "as such". Rather, his approach consisted in a specific conception of the social sphere which has its own dynamics. In this sense, Marx was a follower of Hegel; there was nothing strange in Marx suggesting that social institutions develop according to their own purposes and goals. It has been, and, perhaps, still is, fashionable to deride such an approach and to assimilate it to another Hegelian concept, viz. the march of the Weltgeist through history. But if a rigorous attempt to explain decisive historical developments in terms of individuals' actions fails (and I think it does), then some kind of 'social determinism' will be needed, as developed by sociological theories, be they structural, systems or functional approaches. In chapter 2, I have analysed Marx's philosophical anthropology; we

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169 I need not conceal that in my view this metaphor is not very illuminating; on the contrary, it often obfuscates illuminating insights (see, also, Lukes (1982) for a critique). But it need also be said that Marx thereby formulated a problem which served as a starting point for sociological research. See only Weber (1905) and Mannheim (1936).

may label his intentions there as "ethical individualistic" ones. But this normative dimension has to retreat when describing or explaining social reality. Marx was aware of this, as he made clear in the foreword to Capital 1: "I paint the capitalist and the landlord in no sense couleur de rose. But here individuals are dealt with only in so far as they are the personifications of economic categories, embodiments of particular class-relations and class-interests. My standpoint, from which the evolution of the economic formation of society is viewed as a process of natural history, can less than any other make the individual responsible for relations whose creature he socially remains, however much he may subjectively raise himself above them."[170]

Marx's social determinism is most clearly expressed in Capital. In respect of technology, his position is the following: machinery can be employed in completely different ways. Capitalism employs it to the detriment of the producers; communism will employ it to the benefit of the producers. Thus it is good per se, but bad under capitalist use. This offers him the theoretical possibility of achieving a social form which produces in a non-alienated way. Note that on the basis of a technological determinism such a perspective might be difficult. It would be difficult if the structure of technology were to impinge on a full development of

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170 Many advocates of methodological individualism seem to confuse ethical and methodological individualism, to use a distinction of Lukes (1971). Or, as Teubner put it, they confuse moral-poiltical options with theory constructions (Teubner 1989a). Many theorists seem to incur the fallacy of embracing an individualistic approach because they consider themselves humanists.

human needs and capacities.[171]

Turning now to Marx's technological determinism, we should first have a clear definition of technological determinism. If we define it in the strongest possible sense, it means that technology determines other social spheres (logical determinism) and that it is the driving force for social change (historical determinism).[172] On the first ("logical") level, we can distinguish between a strong and a weak notion. The strong notion would probably claim

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171 The following passage from Capital 3 can be read as confirmation both for the economic and social determinism: "The specific economic form, in which unpaid surplus-labour is pumped out of direct producers, determines the relationship of rulers and ruled, as it grows directly out of production itself and, in turn, reacts upon it as a determining element... It is always the direct relationship of the owners of the conditions of production to the direct producers - a relation always naturally corresponding to a definite stage in the development of the methods of labour and thereby its social productivity - which reveals the innermost secret, the hidden basis of the entire social structure, and with it... the corresponding specific form of the state." (Capital 3:791) As I shall claim, Marx's central notions sometimes do not permit of precise differentiation between legal, political and economic factors. The concepts "relations of production" and "productive forces" overlap; they cannot be defined independent of one another. In chapter 4, I shall return to this issue, this time seen from the viewpoint of Cohen's claim that the productive forces have primacy over the relations of production which is a technological determinist interpretation.

172 MacKenzie thus refers to both meanings when he writes: "To be a technological determinist is obviously to believe that in some sense technical change causes social change, indeed that it is the most important cause of social change. But to give full weight to the first term in expressions such as "prime mover" and "independent variable", it would also have to be believed that technical change is itself uncaused." (MacKenzie 1984:474)

that to one specific technology, one social form which is determined by this technology exactly corresponds. The weak notion would probably claim that to a specific technology a variety of social forms may correspond, which consequently are thus not determined by technology; rather, they are "allowed by" or "compatible with" that technology. Marx sometimes invokes the weak, sometimes the strong notion. The weak version is present when he says that artisan technology was the technology of slavery and feudalism; the strong version is present when he says that capitalism is only capitalism when it is machine-based. However, the technological basis of capitalism (together with the cooperative character of the labour process) will also serve communist society, which again would suggest the weak version of the argument. It seems that an evolutionary approach requires the weak version, because all elements of a new social form must be already present at the prior stage and are always common to both social forms.[173]

Turning to the historical dimension, we must note that Marx does not favour the technological argument. He says that both forces of production and relations of production are caught in an evolutionary development. There are examples of the importance of techno-

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173 I think that the strong notion cannot be supported in a consistent way. The evolutionary approach advises us to subscribe to the weak notion. The weak notion does not allow for any combination, it only rules out specific combinations. We should thus take into consideration the possibility of functional equivalents (see Luhmann 1971). Marx, on some occasions, seems to forget his evolutionary approach because he cannot withstand the temptation to establish a rigid connection between technology and social form.

logical factors[174] as well as examples of the importance of social and political factors[175].

MacKenzie (1984) is also dealing with the question if Marx can be called a technological determinist. Commenting on the 1859 Preface "as the definitive statement of historical materialism" (MacKenzie 1984:476), he writes:

> "Anything approaching a careful reading of it quickly reveals two things. First, to make it into a statement that machines make history, the "forces of production" would have to be interpreted as equivalent to technology. Second, to make it into a strong technological determinism in the sense outlined above, the development of the forces of production would have to be taken as autonomous, or at least independent of the relations or production." (MacKenzie 1984:476).

In my view, the first point causes no problems, since technology can be conceived as containing skills, knowledge, and experience.[176] More intriguing is the second question. G.A. Cohen has tried to make the second point in the strongest possible way, claiming that "(a) The productive forces tend to develop throughout history (the Development thesis). (b) The nature of the

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174 As when he holds that capitalism and communism cannot be based on artisan technology.

175 As when he holds that only with the abolition of the guild laws and the consequent establishment of a labour-market, only with the discovery of new continents and the import of precious metals (CW 6:185) could capitalism grow up.

176 Habermas overemphasises these non-material elements of productive forces. He defines Produktivkräfte as consisting of a) labour power; b) knowledge which can be translated into productive techniques; c) knowledge which organises, mobilises and qualifies labour power. Cf. Habermas (1976:152-3).

production relations of a society is explained by the level of development of its productive forces (the Primacy Thesis proper)." (Cohen 1978:134) Furthermore, Cohen's intention is "to use (a) as part of the argument for (b)." (Cohen 1978:153). In other words, if technology can be shown to be the unmoved prime mover, MacKenzie's conditions would be fulfilled. I postpone the discussion of this point to chapter 4, but nevertheless will make a judgement at this point: Marx did not employ technological determinism in a consistent way;[177] rather, he was tempted several times to use it as an additional argument for his theory.

3.5. Technological alienation

My suspicion in 3.1.1. was that Marx runs into a theoretical difficulty when simultaneously endorsing an evolutionary approach towards technology and a normative humanist standpoint. Above, the two elements were made compatible by an interpretation which sees technological evolution as paralleled by an increase in human capacities. The total individuals were the result of an objective unfolding historical process, of "blind" evolution. But what if this diagnosis is not plausible? The tension between the two elements turns into a contradiction if the historical and the critical level cannot be reconciled. If there was to be no technology which permitted the realization of Marx's humanist programme, he would have remained pessimistic. In fact, as we shall see, underlying his theory was optimism.

3.5.1. Technological alienation in the Manuscripts 1861-3

177 See Heilbronner, (1967), for a statement that Marx was an explicit technological determinist.

The forementioned problem gives me a strong reason for locating technological alienation in Marx's discourse of the Manuscripts 1861-3. It is the characteristic of the machine itself (and not its employment by capital) which expropriates his abilities from the worker, which transfers his skill to the machine.

Before going into greater detail, I first discuss briefly the notions of alienation, reification and fetishism.[178] The concept of fetishism derives from the Portuguese "feitico [lat. factitius] and means "artificial", "false" and "magic". It was first employed in ethnology, but also in philosophy (Schelling, Hegel, Kant), sociology (Comte), physics and psychoanalysis. It denotes the phenomenon when objects produced by people are invested with apparent power (cf. Seidel 1972). Objects do not have that power inherently, but the attribution of power to them by their producers generates their own apparent power. The fetish character of commodities arises because their social character is established only after the production i.e. after the use-values have experienced exchange and proven their exchange-value. If all labour would be performed as social labour from the outset, there could be no fetishism. Marx refers above all to commodity, money and capital fetishism; the first two he explains at the beginning of volume I of Capital; he returns to the third at several places throughout Capital, culminating in the "Trinitarian formula" (volume III).

178 The term "Verdinglichung" was first used in a systematic way by Lukacs, who, in his early formulation, suggested an identity of "Verdinglichung" and "Entfremdung". See his later self-criticism in the 1967 Preface to Geschichte und Klassenbwußtsein. See also Petrovic (1983), and Geras (1983b), for definitions.

In a passage in the Grundrisse, Marx links the concept of alienation quite tightly to the concept of fetishism. There he compares the function of money with the function of "lists of current prices". He says: "Money... serves as such only because of its social (symbolic) property; and it can have a social property only because individuals have alienated their own social relationship from themselves so that it takes the form of a thing." (Grundrisse:160). Lists of current prices provide information about the activities of all others on the world market (cf. p.161) and are "the best proof of the way in which their own exchange and their own production confront individuals as an objective relation which is independent of them." (Grundrisse:161). The three concepts reification, fetishism, and alienation can be seen here as forming the structure of a situation "unworthy of human nature": (1) a social relation takes the shape of a thing; (2) this thing is invested with a power of its own; (3) this power reacts upon the individuals as an independent force. (1) stands for reification, (2) for fetishism, (3) for alienation. Marx here compares money and lists of prices with the result that (2) does apply to money but not to the lists of prices. From this Marx seems to conclude that the "Aufhebung" of alienation is easier in the latter case. He writes: "In the case of the world market, the connection of the individual with all, but at the same time also the independence of this connection from the individual, have developed to such a high level that the formation of the world market already at the same time contains the conditions for going beyond it." (Grundrisse: 161)[179].

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179 Cf. Keynes' drastic statement which may serve here to make the distinction clearer. Writing about a furture society, he says: "We shall be able to afford to dare to assess the money-motive at its true value. The love of money as a possession - as distinguished from the love of money as a

Consider, now, an application of this triad to technology. Obviously, (1) is not relevant here, since man's relationship to nature is nearly always mediated by things. The relation to nature is no social relation which then assumes the form of a thing, nay, it is already in the first place a "dinghaft" relation, it is in its very nature characterised by the use of things. However, (2) and (3) are relevant, as we can see in every treatment of the matter by Marx.

According to Ricoeur, Marx in his Paris Manuscripts employed a Hegelian model when he analysed

> "the inversion of human labour into an alien, foreign, seemingly transcendent entity. Therefore, the transformation by which the subjective essence of labour... is abolished and lost in a power that seems to rule human existence becomes the paradigm for all similar processes. Something human is inverted into something which seems to be exterior, external, superior, more powerful, and sometimes supernatural." (Ricoeur 1986:35).

Ricoeur rightly insists that - in contrast to the dogmatic Marxists - there is no fundamental economic alienation from which all other forms of alienation are derived; rather, these other alienations are analogical to the Feuerbachian construction (cf. Ricoeur 1986:36). Consider, for example, Marx's description of money-fetishism:

> "Their power [of gold and silver] appears as a kind of fate, and the consciousness of men, especially in social orders declining because

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> means to the enjoyments and realities of life - will be recognised for what it is, a somewhat disgusting morbidity, one of thise semi-criminal, semi-pathological propensities which one hands over with a shudder to the specialists in mental disease" (Keynes 1931:329)

> of a deeper development of exchange-value relations, rebels against the power which a physical matter, a thing, acquires with respect to men, against the domination of the accused metal [verfluchtes Metall] which appears as sheer insanity." (CW 29:487).

If Marx's enterprise is characterized by a strong anthropocentric (critical) approach, this must inevitably be in opposition to the "machino-centric" description of capitalist reality of production.[180] Marx, however, does not care to show how an "Aufhebung" of this contradiction is possible, how a new, socialist "machine" can be imagined. Following the "materialist" advice of Marx, this new "machine" would have to still emerge under the old conditions, i.e. in capitalism. However, he himself does not show this and he gives us no touchstone to indicate that it should at all. We can only presume that he aimed at a similar thing when he writes:

> "Es characterisiert überhaupt die capitalistische Production, daß die Arbeitsbedingungen der lebendigen Arbeit selbständig, personnificirt gegenübertreten, daß nicht der Arbeiter

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180 Heidegger's position can be interpreted as a straightforward position of technological alienation. The "essence" of modern technology, according to him, can neither be understood in terms of instrumentality (means-ends-relationship), nor in terms of human activity. The essence of modern technology is rather that it is concealing instead of revealing. "[M]odern technology does not unfold into a bringing-forth in the sense of poiesis. The revealing that rules in modern technology is a challenging [Herausfordern], which puts to nature the unreasonable demand that it supply energy which can be extracted and stored as such." (Heidegger 1978:296). Nature becomes an object of ordering, a "standing reserve". Even man is involved in this process, although he is never "transformed into mere standing reserve. Since man drives technology forward, he takes part in ordering as a way of revealing." (Heidegger 1978:300). This is not the place to deal with the exact structure of Heidegger's argument; suffice it to say that, for him, "[m]odern technology, as a revealing which orders, is thus no mere human doing." (ibidem).

> die Arbeitsbedingungen, sondern die Arbeitsbedingungen den Arbeiter anwenden. Gerade dadurch werden die letztren Capital und der Waarenbesitzer, der sie aneignet, Capitalist." (MEGA II.3.6.:2014) .

According to this outline, a post-capitalist society would be a society in which the workers employ the means of production ("im Accusativ anwenden", as Marx says - instead vice versa, as in capitalism). The creation of a new social form (=abolishing of capital) is accompanied by a new technological form (=abolishing of enslaving work). Marx aims at overcoming these "contradictory forms" of social production: "Sobald diese gegensätzliche Form wegfällt, ergibt sich also, daß sie dies Productionsmittel gesellschaftlich, nicht als Privatindividuen besitzen." (MEGA II.3.6.:2144).[181]

Since technology in capitalism assumes the form of fixed capital, two things exert domination over the worker: capital and technology. Capital and machinery in their evolution and in their functioning are acting in pairs, reinforcing each other, conditioning each other. The one is not possible without the other. It takes only a small step for Marx to assume that the Aufhebung of the capital-labour-relation would also lead to a Aufhebung of deskilling machinery. But Marx does not devote any discussion to this special problem. He only states in a very general way that workers in post-capitalist society will possess the means of production socially, not as private individuals.[182]

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181 Note that the new must be already there and is set free ("unfettered"). Cohen called this the "liberation of the content" (Cohen 1978).

182 Cf. MEGA II.3.6.:2144

In the Manuscripts, Marx is a technological determinist when backward-looking and a social determinist when forward-looking. In Capital, Marx tries to get out of these theoretical difficulties and gives the following solution: his argument builds exactly on the "social character of labour". He claims that in capitalist modern industry the character of labour is immediately social and cooperative; all that needs to be done is the expropriation of capital. The advantage of this solution readily springs to mind: it is consistent with his evolutionary approach ("new productive forces do not drop from the sky", Grundrisse:278), and at the same time fits his normative criteria. Only in this way could he bring together the explanatory and the evaluative strand of his project. We may thus say that although his approach in Capital is far more "social determinism", he nevertheless allows for an technological argument, too. This occurs when he claims that the social institutions have to adapt to the "technical necessity" (Capital 1:365) of the labour process.

3.5.2. How Marx changed his view: Manuscripts vs. Capital

It is most interesting to what degree Marx maintained this definition of machine and its corollaries in his final version of Capital. One could show in great detail how he used the material from the 1861-3 Manuscripts for the formulation of chapter 13 (15 in the English version) of Capital. But at first sight there seems to be a slight difference in the definition of the machine. In Capital, he defines it as follows: "The machine ... supersedes the workman, who handles a single tool, by a mechanism operating with a number of similar tools, and set in motion by a single motive power, whatever the form of that power may be. (Capital 1:355).

Marx also repeats that skill of the worker is transferred to machinery: "Along with the tool, the skill of the workman in handling it passes over to the machine." (Capital 1:396). But the "slight difference" turns out to be a radical cut between a machinery "as such" and the really existing one (of capitalism). He cites Ure for the two different aspects of the automatic factory ("automatische Fabrik" as Marx calls the "Atelier" now). The first is " '[C]ooperation of many orders of workpeople ... in tending with assiduous skill, a system of productive machines, continuously impelled by a central power' (the prime mover)" (Capital 1: 394-5). The second is "a vast automaton, composed of various mechanical and intellectual organs, acting in uniterrupted concert for the production of a common object, all of them being subordinate to a self-regulated moving force." (Capital 1: 395).

Now look at Marx's comment: "The first description is applicable to every possible employment of machinery on a large scale, the second is characteristic of its use by capital, and therefore of the modern factory system." (Capital 1:396).

But this distinction is completely artificial having no real basis in the text of Ure. Marx has nowhere shown what "every possible employment of machinery on a large scale" could mean. Additionally, the first passage of Ure in support of a "neutral" use of machinery is self-defeating. Here it is clearly expressed that the workers only overlook ("überwachen") a system of productive machinery. No virtuosity is inherent in the workers, as Marx himself asserts on the next page.[183] Marx could not rest

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183 "Hence, in the place of the hierarchy of specialised workmen that characterises manufacture, there steps, in the automatic factory, a tendency to equalise and reduce to one and the same level every kind of work that has to be done by the minders of the machines..." (Capital 1:396)

content with such a perspective. Communism would have to abolish the reduction of workers into mere "appendages" to machinery. Marx, however, is a materialist. He could neither be content in proclaiming such a goal for communist society or advocate a return to the medieval "masterpiece" (see his polemic against Proudhon, CW 6:190). He must show a real possibility for abolishing enslavement in the production process which stems from technological factors.

It might be that Marx became aware, after the 1861-3 Manuscript that he was caught in the "technological trap", that he must provide a new technological "elementary form" for post-capitalist society which - this not being enough - must be already visible under present conditions. Since he could not provide this, he constructed it in a somewhat obtuse way from Ure's text. Marx has two possibile ways with which to defend his materialist programme:

(a) he can claim that machines can be used in other than capitalist ways;

(b) he can claim that under communism another technology will be used in the process of material production.[184]

His strategy combines both points. He follows a) in that he takes great pains to show how the liberating potential of

184 But, as already indicated, this new technology would have to emerge first under capitalism. Or, taking up the formulation of Loh (1975), it would have to emerge as a new combination of existing elements.

machinery is not (and cannot) be set free under capitalism. [185] He develops b) above all with respect to the character of the labour process (see 3.6.)

The introduced distinction, however, has big consequences for Marx's further analysis in Capital; we can say that it changes the character of his discourse completely. It becomes the guiding thread for the remainder of the 13th chapter. We find a dozen passages like the following: "Here as everywhere else, we must distinguish between increased productiveness due to the development of the social process of production, and that due to the capitalist exploitation of that process." (Capital 1:398) Marx's strategy in chapter 15 is simple: he attributes all negative features of machinery (essentially those which oppose his theory of human nature) to the capitalist use; the positive features he attributes to "Maschierie an sich". [186]

Marx provides examples like intensification of work, child and woman-labour, lengthening of the working day etc. to prove the capitalist use. He stresses these features more than the transfer of skill. It is no exaggeration to say that he actually substitutes the one for the other. The two, however, are of a different theoretical status. The first is historical (and thus contingent) the second analytical. The only analytical instance

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185 The main point is the increased productivity which allows the producing of more output with a given portion of labour power. This means that the working day can be reduced drastically; and free time, we know with Marx, is important and left for the development of the individual, cf. MEGA II.3.1.:275; MEGA II.3.6.:1909-10; 2088-9.

186 His evolutionary scheme thus anticipates a 'mutation' only of the relations, and the mode of, production, not of technology.

(in Capital) is the (spurious) "Ure-distinction", the others are historical.[187] Now Marx seems to overemphasize the difference between the use of machinery by capital and the character of machinery as such. The expropriation of skill is no longer central, as it was in the Manuscripts. To make it plain: if capitalists would refrain from using women and children in the production process, from lengthening the working day past its natural limits etc. their use of machinery would nevertheless be capitalist (and not "neutral" application of machinery "as such").

Another instance for Marx's adherance to strategy a) is the fact that machinery is used by capital as a tool for warfare against the workers. As Berg pointed out, "Ure's automatic factory was the image of war" (Berg 1982:201). Indeed, Marx himself was to use this parallel, too. He writes:

> "But machinery not only acts as a competitor who gets the better of the workman, and is constantly on the point of making him superfluous. It is also a power inimical to him, and as such capital proclaims it from the roof tops and as such makes use of it. It is the most powerful weapon for repressing strikes, those periodical revolts of the working-class against the autocracy of capital... It would be possible to write quite a history of the inventions, made since 1830, for the sole purpose of supplying capital with weapons against the revolts of the working-class."

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187 Needless to say that the Manuscripts abound with analytical examples: "Dieß ist der sehr große Unterschied: ob die vorhandnen Productionsmittel ihnen als Capital gegenüberstehn, und daher nur so weit von ihnen angeeignet werden können als nöthig um den surplusvalue and the surplusproduce for their employers zu vermehren, ob diese Productionsmittel sie beschäftigen, oder ob sie, als Subjekte, die Productionsmittel im Accusativ anwenden, um Reichtum für sich selbst zu erzeugen." (MEGA II.3.3.:1195)

(Capital 1:410-1)[188] .

This warfare, according to him, is no technological feature; rather, it is a social feature of class struggle, where capitalists use machinery as weapon to become independent of special workers' skills. To repeat: this is the approach Marx adopts in Capital. In the Manuscripts, however, he additionally defines the conflict as one between the "iron man" and the man "of flesh and blood":

> "Hier tritt auch die vergangne Arbeit - im Automaten und der von ihm bewegten Maschinerie - als scheinbar unabhängig von der Arbeit selbstthätig, statt ihr untergeordnet sie unterordnet [should read: unterordnend, R.G.] auf, der eiserne Mann, gegen den Mann aus Fleisch und Blut. Die Subsumtion seiner Arbeit unter das Capital... die im Begriff der capitalistischen Production liegt, erscheint hier als technologisches Factum. Der Frontstein ist fertig. Die todte Arbeit mit Bewegung begabt und die lebendige nur noch als eines ihrer bewußten Organe vorhanden." (MEGA II.3.6.:2057-8, my emph.).

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188 See also the following passage from the Manuscripts: "Hier also erst recht die Entfremdung, die die objektiven Bedingungen der Arbeit - die vergangne Arbeit - gegen die lebendige annehmen, als direkter Gegensatz, indem die vergangne Arbeit, also die allgemein gesellschaftlichen Kräfte der Arbeit, Naturkräfte und Wissenschaft eingeschlossen, direkt als Waffen erscheinen, theils um Arbeiter aufs Pflaster zu werfen, ... theils um seine Specialität und die auf derselben gegründeten Ansprüche zu brechen, theils um ihn der im Fabrikwesen fertig organisierten Despotie und militärischen Disziplin des Capitals zu unterwerfen. In dieser From am entschiedensten erscheinen daher die aus der gesellschaftlichen Productivkraft der Arbeit und die von der Arbeit selbst gesetzten gesellschaftlichen Bedingungen der Arbeit, nicht nur als dem Arbeiter fremde, dem Capital gehörige Kräfte, sondern als gegen den einzelnen Arbeiter im Interesse des Capitalisten feindlich und überwältigend gerichtete Kräfte..." (MEGA II.3.6.:2057-8, my emph.)

This passage echoes again a formulation of Ure, who wrote in 1835:

> "Thus the Iron Man, as the operatives fitly call it, sprung out of the hands of our modern Prometheus at the bidding of Minerva - a creation destined to restore order among the industrious classes, and to confirm to Great Britain the empire of art" (Ure 1835:367, cited in Berg 1982:201).

Though Ure says that "[t]he news of this Herculean prodigy spread dismay through the union, and even long before it left its craddle, so to speak, it strangled the Hydra of misrule," (ibidem), this does not to stand up to closer scrutiny. As Lazonick (1979), has shown, the shop-floor organisation continued even after the introduction of the self-acting mule.[189]

However, the quote from Manuscripts also reveals that Marx discerned alienation on the technological level alone. This comes out when he uses the term Frontstein (keystone, coping stone) which draws to mind architecture. The picture is of an arch which

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189 See also the account of Piore and Sable: "In 1830 ... the Manchester engineering firm of Sharp, Roberts & Company introduced the self-acting mule, and promised its customers that the new equipment would allow the substitution of unskilled machine operators for skilled cotton spinners - thus putting an end to the spinners' union in the mills. Ure, a political economist and industrial consultant, popularized this claim as a statement of fact; Marx (who called Ure the Pindar of the factory) accepted this account and, as we saw, made it a starting point for his reflections on the decisive role of special-purpose machinery in modern industry. Yet the cotton spinner's role in production - part supervisor, part recruiter of labor - was far more complex, and management's grip on the shop-floor activity far more limited, than the machine maker, the consultant, and the theorist imagined. The spinners' (now called minders') union not only survived but gained extensive control over the use of the new technology." (Piore and Sabel 1984:45).

is completed by a keystone. This keystone prevents the construction from collapsing and provides its stability. The worker gets expropriated of his skills and of his product; it is capital which accumulates both and represents itself as the living subject: dead labour which is able to move on its own; living labour which serves only as an appendage to it.

> "Die Vermehrung der Produktivkraft, die aus der Theilung der Arbeit, dieser gesellschaftlichen Daseinsweise der Arbeit hervorgeht, ist also nicht nur Productivkraft des Capitals, statt Productivkraft des Arbeiters. Die gesellschaftliche Form dieser combinirten Arbeiten ist das Dasein des Capitals gegen den Arbeiter; die Combination tritt ihm als übermächtiges Verhägniß entgegen, der er verfallen ist durch die Reduction seines Arbeitsvermögens auf eine ganz einseitige Function, die getrennt von dem Gesammtmechanismus nichts ist... Er [d.Arbeiter, R.G.] ist selbst zu einem blosen Detail geworden." (MEGA II.3.1.: 254, my emph.).

"Mit der Maschinerie... erhält die Herrschaft der vergangenen Arbeit über die lebendige, nicht nur sociale,... sondern technologische Wahrheit." (MEGA II.3.6.:2059. This passage contains in a nutshell both a technological determinist and a fetishist position - a position which Marx in Capital is going to blur.

3.6. Alienation and the division of labour

The concept of "division of labour" has had a long career from ancient Greek Philosophy to Political Economy of Marx's time. It is essentially a concept which lacks precision since every author and every epoch uses it in a different way. Authors, like Marx, who try to use the concept to cover many phenomena are thus easily confused in their argument.

My claim is that the "division of labour" is a rather complex subject in Marx; it covers many things and this ensures confusion, if one does not distinguish very carefully between the different meanings. Marx himself was aware of this danger when he criticised Proudhon for using the concept "division of labour" in such a vague way. Marx's point was that the concept covers too many different things which do not have much in common and thus can hardly be understood by the term "divide" (cf. CW 6:180).

It is most intriguing, too, to see the commentators of Marx slipping into quasi-contradictory statements: as, for example, Stanley Moore, when he writes that Marx in the German Ideology indicates that "division of labour will be transcended in communist society" (Moore 1980:25), after a few lines stating that Marx, in the passage from the German Ideology, "depicts ... a situation where specialisation has ended but differentiation of functions remains" (ibidem). Similarly, Agnes Heller writes: "Without doubt the social division of labour will cease, and with it the division of society into exploiters and exploited ..." (Heller 1976:105). However, only five lines below she considers it possible that in Marx's framework "a division of labour continues to exist in another sense of the term" (ibidem). This pinpoints the problem: we must know which sense of the term we mean when talking about the concept "division of labour".

But why, then, am I interested at all in the concept and especially in connection with technology? I think that both technology and the division of labour are essential for Marx's discussion of the "good society", i.e. for his communist perspective. Both technology and division of labour in communist society must be of a kind that they exert minimal "enslaving effects" on individuals. But both are, on the other hand, main "agents" in the development

of the preconditions for a communist society. They develop possibilities of transport and communication (world market), reduce the social necessary labour, lead to an increase in productivity: in short, they contribute to the creation of real wealth. But they do not bring about this real wealth completely; all they do under capitalist relations is produce material wealth ("sachlicher Reichtum"), and this only in antagonistic forms (poverty, economic crises etc.) Marx's concept of division of labour has - like his concept of technology - an historical and critical dimension.

3.6.1. The concept in Marx

In what follows, I am especially interested in the question how Marx, similar to his treatment of technology, employed a "double" concept of division of labour. More specifically, I am asking if Marx was consistent on the historical and critical level when discussing the division of labour.

In his early writings the concept of division of labour is almost completely critical.[190] The division of labour is an evil which leads to the fragmentation of individuals (separation of manual and mental tasks) and to the fragmentation of mankind (separation into classes) and which, therefore, must be abolished. Ricoeur convincingly argues that in the German Ideology the concept of 'division of labour' has the same function as 'alienation'

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190 As Evans has pointed out, Marx in his early Paris Manuscripts "accepts Smith's views on the division of labour, and follows him in his failure to distinguish between the social division of labour and the workshop division of labour; or between the division of labour in Manufacture and the division of labour in Modern Industry. Later, Marx was to see Smith as the political economist of the period of Manufacture." (Evans 1984:142-3).

in the Paris Manuscripts. (1986:84).[191] However, as Fetscher puts it, Marx in his mature works "no longer pretends that the division of labour will altogether disappear. Certainly there will be different social functions and people to fill them..." (Fetscher 1973:461)[192]

The Poverty of Philosophy may be regarded as a turning point where Marx partly continues his critical approach, approvingly citing Adam Smith's point that people's different abilities were not so much the cause but the effect of the division of labour: "A porter differs less from a philosopher than a mastiff from a greyhound. It is the division of labour which has set a gulf between them." (CW 6:180)[193] .

But, on the other hand Marx in this text approaches economic concepts (in opposition to Proudhon) in a historical and

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191 But even in the German Ideology we find one instance for the necessity of a social division of labour - see CW 5:47.

192 See, also Moore, (1980:41) for the same view. This interpretation is further supported by the following statement from Capital where Marx speaks of the "...fully developed individual... to whom the different social functions he performs, are but so many modes of giving free scope to his own and acquired powers." (Capital 1:488, my emph.); cf. also Critique of the Gotha Programme: "[W]hat social functions will remain in existence [in communist society] that are analogous to present state functions? This question can only be answered scientifically.." (SW 3:26).

193 But Marx is not consistent here. A few pages later he speaks of the "separation of the different parts of labour, leaving to each one the opportunity of devoting himself to the speciality best suited to him..." (CW 6:183, my emph.) This is also the position adopted in the later works; it appears under the label of 'natural' division of labour which Marx thinks exists in every social formation, i.e. division of labour based on sex, age, personal endowments, geographical factors etc. (cf. Capital 1:351).

explanatory way. Thus he stresses the fact that general concepts like division of labour may cover many different things which do not have much in common and thus can hardly be understood by the term "divide" (see CW 6:180). This insight Marx derived from his reading of Ure and Babbage during his stay in Brussels in 1845 (see Evans 1984:143). It was especially Ure's emphasis that the periods of manufacture and automatic machinery were completely distinct which motivated him to reject Proudhon. According to his new view, the division of labour is no universal phenomenon but rather limited to a specific historical epoch. It partly occured in ancient Greece[194] but it was only fully developed under the conditions of commodity production on the basis of different professions i.e. in capitalism's early period of manufacture.[195]

It is interesting to see to what degree The Poverty of Philosophy anticipates the discussion of Capital. It is a most intriguing issue since both works contain a certain tension with respect to the evaluation of machinery and division of labour. On the one hand, Marx assumes that the introduction of machinery leads to a

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194 Xenophon, Plato, Aristotle, Thukydides were concerned with quality (and hence use-value): it was therefore assumed that each man should dedicate himself only to one art, work etc. They also assumed an innate capacity of each individual to perform certain work. Marx reports: "Die verschiedenen Bedürfnisse in einem Gemeinwesen erheischen verschiedene Thätigkeiten zu ihrer Befriedigung; die verschiedenen Anlagen befähigen verschiedene Menschennaturen besser zu dieser als jener Thätigkeit. Daher Theilung der Arbeit und ihr entsprechend verschiedne Stände. Was Plato überall als die Hauptsache hervorhebt, daß so jedes Werk besser gethan wird." (MEGA II.3.1.:259-9).

195 The main difference between ancient Greece and the period of Manufacture was that the ancient division of labour was concerned with the quality of products whereas Manufacture was concerned with quantity; see Adam Smith's famous example of the pin-production.

further fragmentation of the worker. Thus he writes in The Poverty of Philosophy:

> With the introduction of machinery the division of labour inside society has increased, the task of the worker inside the workshop has been simplified... the human being has been further fragmented. (CW 6:188, amended transl.).

In Capital we read:

> [T]he detail-worker of today, crippled by life-long repetition of one and the same trivial operation, and thus reduced to a mere fragment of a man... [will be replaced] by the fully developed individual..." (Capital 1: 458).

But, on the other hand, Marx suggests that the introduction of Machinery leads to a variation of aptitudes, ultimately to a more fully-developed individual. In the The Poverty of Philosophy we read that a trend toward universality arises, "the tendency towards an integral development of the individual begins to be felt." (CW 6:190) In Capital, Marx gives the reason for this development:

> Modern industry, through its catastrophes, imposes the necessity of recognizing, as a fundamental law of production, variation of work, consequently the fitness of the labourer for varied work, consequently the greatest possible development of his varied aptitudes. (Capital 1:458).

The meaning of this passage is not only that because 'fitness for varied work' is functional for capitalism it is realised. It is also a statement about every modern industrial society, not only in its capitalist form. As Fetscher observed, "the very nature of modern industrial production and the rapid change of its technology will demand more many-sided individuals..." (Fetscher 1973:461).

But note, also, a very subtle difference between The Poverty of Philosophy and Capital. In The Poverty of Philosophy Marx ridicules Proudhon's juxtaposition of the division of labour and machinery:

> "Nothing is more absurd than to see in machinery the antithesis of the division of labour, the synthesis restoring unity in divided labour." (CW 6:186).

But it seems that Capital comes close to exactly this position. Here Marx on the one hand claims that machinery has stopped the division of labour on the other, emphasizing the cooperative and social character of production. I return to this question in a moment.

In the Grundrisse, Marx stresses the beneficial consequences of the division of labour for the prospects of mankind. This judgement is based on the the important contribution of the division of labour for the development of the productive forces. In one passage Marx attributes to the division of labour the role of the 'driving force' of historical dynamics which in the end will lead to the supersession of capitalism (see Grundrisse:159). The critical evaluation of this process is shifted to what we might call 'powerlessness' of individuals. It refers to the fact that individuals have to subordinate themselves under relations which exist independently of them and which are alien to them.[196]

> Individuals are subsumed under social production; social production exists outside them as their fate; but social production is not subsumed under individuals, manageable by them as their common wealth." (Grundrisse:158).

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196 As we shall see below, this is the essence of Marx's critique of capitalism, a critique which informs his view of a communist society.

We may conclude from this that Marx would allow for a certain social division of labour, as far as it is the product of the associated individuals.[197]

Heller summarised Marx's intention very well: "Marx attacks those theoreticians who tie the specialisation which arises from centralisation to capitalist relations of production, 'as if the division of labour were not likewise possible if its conditions belonged to the associated workers, and were regarded by the latter as their own activity, which they are by their very nature.'" (Heller 1976:108; Marx quote in Theories of Surplus Value, cf. MEGA II.3.4.:1405) Heller contends that the bourgeois economists want to achieve by this identification a justification for the capitalist mode of production. As Marx put it, they seek "a technological justification for the specific social form, i.e. capitalist form, in which the relationship of labour to the conditions of labour is turned upside down, so that it is not the worker who makes use of the conditions of labour, but the conditions of labour which make use of the worker." (cited in Heller, ibdidem; cf also MEGA II.3.4.:1409)[198].

This overview has not only shown how closely the historical and critical level are intertwined in Marx's discussion of the division of labour and modern industry, but also that his critical approach is not unequivocal. He considers division of labour to be

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197 Selucky in his (otherwise illuminating) treatment of the division of labour is thus mistaken when he says: "Be that as it may, Marx and Engels wanted to abolish the division of labour." (Selucky 1979:10)

198 Cf., also Habermas' claim that technology in late capitalism takes the form of ideology, since "Sachzwänge" are blamed instead of obsolete power relations. See Habermas (1971b:59).

both a positive and negative thing at one and the same time. The positive side is that it contributes to the increase in productivity, thus contributing to the material preconditions for communist society. The negative side is that it contributes to enslaving effects i.e. that individuals get subsumed under a life-long task which hinders their development into "total" individuals.[199] Now, it would be naive to think that communism could do away with the division of labour because the necessary levels of material wealth would already exist. The reproduction of wealth recquires a certain social organization of labour, which may be called "division of labour". From this follows that communist society must develop a social form of division of labour which exercises no enslaving effects.[200] Unfortunately, Marx dedicated little attention to the topic of division of labour in society. It seems that he would see an inverse relationship between the division of labour inside the factory and the division of labour in society: the less division of labour inside the factory, the more division of labour in society.[201] My conjecture is that he does see the trend

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199 In Capital 1:343 Marx cites Urquardt with approval: "To subdivide a man is to execute him, if he deserves the sentence, to assassinate him if he does not... The subdivision of labour is the assassination of a people."

200 Both in the early German Ideology and in the Critique of the Gotha Program, from 1875 Marx explicitly assumes separate "social functions" to exist in a communist society. See CW 5:47; SW 3:19,26; see also Grundrisse:158.

201 Actually, the place where this quote occurs deals with manufacture but I think it fits the stage of machinery as well: "The division of labour in the workshop implies concentration of the means of production in the hands of one capitalist; the division of labour in society implies their dispersion among many independent producers of commodities... [I]n a society with capitalist production, anarchy in the social divsion of labour and despotism in that of the workshop are mutual conditions the one of the other..." (Capital

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towards a functionally-differentiated society, which, however, will be reversed at a certain stage of historical development.[202]

3.6.2. The Division of Labour: Manuscripts vs. Capital

As I said, Marx's main interest was to reduce the fragmentary effects of the division of labour and, as a prerequisite thereto, the exploration of the possibility. Marx, at least from the Grundrisse onwards, knows a natural division of labour which is based on personal endowments and geographical and climatic factors[203] and an occupational, professional division of labour which found its most adequate expression in the system of

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1:336-7). Capitalist society is only able to organize its tasks with the help of despotism and anarchy which to Marx must have appeared as a very undesirable state of affairs.

202 See also Elster: "Like Weber and Durkheim, Marx thus saw the progress of history up to the present as one of constant differentiation. Unlike them, he did not see this as an irreversible process, but predicted that there would occur a final stage of integration, or loss of differentiation." (Elster 1985:113).

203 "Hodgskin bemerkt richtig, daß Theilung der Erwerbszweige, also der gesellschaftlichen Arbeit, in allen Ländern und unter allen politischen Institutionen Platz greift. Sie existirt ursprünglich in der Familie, wo sie naturwüchsig aus physiologischen Unterschieden, Geschlechts- und Altersunterschieden hervorgeht. Die Verschiedenartigkeit der individuellen Organisationen, körperlichen und geistigen Anlagen wird neue Quelle derselben. Dann aber kömmt durch verschiedne Naturbedingungen ... [geographischer und klimatischer Art, R.G.], Verschiedenheit in den natürlich vorgefundenen Arbeitsinstrumenten hinzu, die die Erwerbszweige verschiedner Stämme theilt und in dem Austausch derselben haben wir überhaupt die ursprüngliche Verwandlung von Product in Waare zu suchen." (MEGA II.3.1.:266-7).

manufacture. modern industry destroys this division of labour and leads to a form of cooperation.[204] Marx's political perspective is to regulate this cooperation socially[205] and to allow for an all-round education and training of the whole working population (Capital 1:458). He refuses to return to the ideal of the craftsman as Ricoeur pointed out:

> For Marx, we must push the industrial system to its last consequences in order to achieve a solution at the level of the illness. The nostalgia of romantics for an earlier labour situation is thus misplaced. The craft worker who made a complete work still did not control the market; the value of the work was determined by someone else." (Ricoeur 1986:53)

Marx strongly opposed a life-long subordination of individuals to specialised tasks in all of his works; in other words, he opposed a fusion of occupational and technical division of labour. The division of labour within society is, however, a broader concept than the division of tasks: the occupational division of labour is only one part of the social division of labour.

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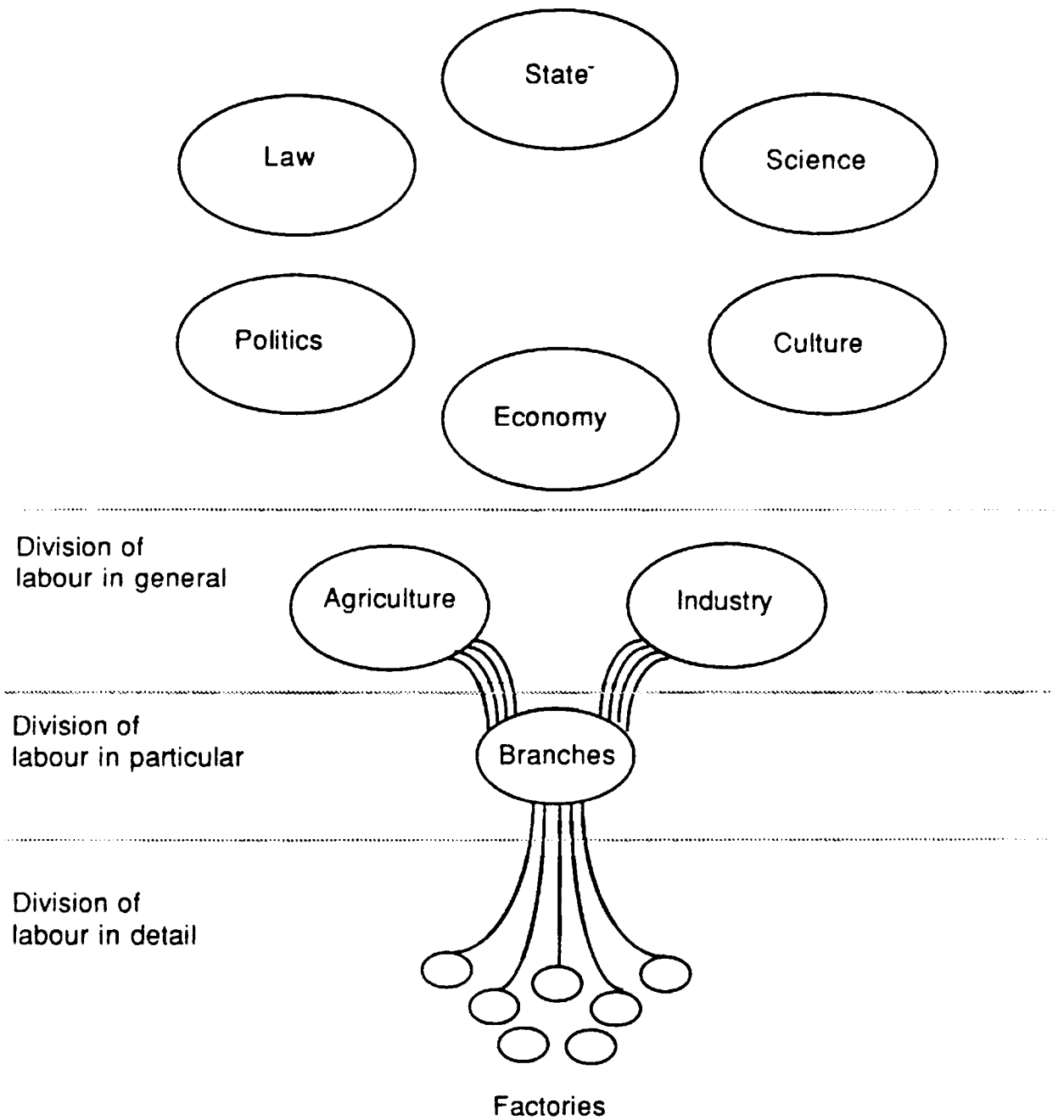
204 According to Marx the concept of cooperation is the universal form of which the division of labour is only a special case: "Dieß ist die Grundform, Theilung der Arbeit setzt Cooperation voraus oder ist nur eine spezifische Weise derselben.. Die Cooperation ist die allgemeine Form, die allen gesellschaftlichen Arrangements zur Vermehrung der Productivität der gesellschaftlichen Arbeit zu Grund liegt... Cooperation ist also zunächst das unmittelbare - nicht durch den Austausch vermittelte - Zusammenwirken vieler Arbeiter zur Production desselben Resultats..." (MEGA II.3.1.:229-30) "So z.B. Fischfang. Resultat wenn viele auf einmal - wie bei der Jagd. Bauen von Eisenbahnen. Graben von Kanälen etc." (MEGA II.3.1.:231).

205 Cf. Capital 1:400: "The factory code ... is but the capitalist caricature of that social regulation of the labour-process which becomes requisite in cooperation on a great scale, and the employment in common, of instruments of labour and especially of machinery."

The following figure may help to clarify the different levels and meanings of the concept "division of labour":

Fig. 3.4: Division of labour in society



No doubt the base-superstructure stands behind this model. However, from this model arises an important ambiguity: what Marx calls "division of labour in society" is sometimes a synonym for "social functions", sometimes it describes everything outside the factory. But these two meanings are not identical, as is evident: productive activity inside the factory is one important social function.

In Capital, Marx speaks of the division of labour in general, in particular, and in detail (see Capital 1:331-2). We may identify the different types of division of labour as the three levels in Figure 3.4. [206]

When Marx speaks of the abolition of the old division of labour, it is clear that it is meant to refer to the division of labour inside the factory and which still lingers on from the period of manufacture and is artificially kept alive by capital. Marx wanted to abolish the role of the "detail-worker of today, crippled by life-long repetition of one and the same task...", (Capital 1:458), which was, according to him, a real tendency of machine production under capitalism. The historical and the critical dimension are congruent here.

The distinction between division of labour within society and division of labour within the factory is stressed by Marx in the following way:

> While division of labour in society at large [...] is common to economic formations of society the most diverse, division of labour in the workshop, as practised by manufacture,

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206 Since Marx here examines the division of labour in the sphere of production, he pays no attention to the upper part of the figure.

> is a special creation of the capitalist mode of production alone. (Capital 1:339).

But note that it is manufacture which is characterized by the division of labour. According to Marx, modern industry does not know a division of labour. [207] In modern industry we have a "division between machines", the workers being appendages to it, void of any skill.

This leads me to the intriguing question of the different approach of the Manuscripts from that of Capital. In the former work, Marx depicts the difference between manufacture and modern industry in the following way: in the period of manufacture the instruments of work are subjected to the virtuosity and skill of the worker, hence the division of labour was a real division of labour, a division between different sorts of labour.

> Die Theilung der Arbeit führt zu einer Differenzierung und damit Vereinfachung der Instrumente, die als Arbeitsmittel dienen; daher auch zur Vervollkommnung dieser Instrumente. Aber in ihr bleibt nach wie vor das Arbeitsmittel Arbeitswerkzeug, Instrument, dessen Anwendung von der persönlichen Virtuosität der einzelnen Arbeiter abhängt, Leiter ihrer eigenen Geschicklichkeit ist, in der

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207 "Die Maschinerie - sobald sie capitalistisch angewandt wird...- sezt die einfache Cooperation voraus und zwar erscheint diese... als viel wichtigeres Moment in ihr, wie in der auf Theilung der Arbeit beruhenden Manufactur... Die in der Manufactur entwickelte Theilung der Arbeit wiederholt sich einerseits im Innern des mechanischen Ateliers, obgleich in sehr vermindertem Maaßstab; andererseits, wie wir später sehn werden, wirft das mechanische Atelier die wesentlichsten Principien der auf Theilung der Arbeit beruhenden Manufactur über den Haufen. Endlich vermehrt die Anwendung der Maschinerie die Theilung der Arbeit im Innern der Gesellschaft, die Verfielfältigung der besondren Geschäftszweige und unabhängigen Productionssphären. Ihr Grundprincip ist die Ersetzung geschickter Arbeit durch einfache Arbeit..." (MEGA II.3.1.:294, my emph.).

> That zu seinem natürlichen Organ hinzugefügtes Kunstorgan." (MEGA II.3.1.:269, my emph.).

It is concentration instead of dispersion of the elements of the production process which is characteristic of the manufacture. Marx calls the manufacture the mode of production specifically corresponding to the division of labour (cf. MEGA II.3.6.:270). In modern industry, on the contrary, there exists a division of machines, under which living labour is subjected.

> Die Maschinerie tritt negativ auf gegen die auf Theilung der Arbeit in der Manufactur beruhnde Productionsweise und die auf Basis dieser Theilung der Arbeit producirten Specialitäten des Arbeitsvermögens. Sie entwerthet das so specialisierte Arbeitsvermögen, und reducirt es theils auf einfaches, abstraktes Arbeitsvermögen, theils producirt sie auf ihrer eigenen Basis eine neue Specialisierung desselben, deren Characteristikum die passive Unterordnung unter die Bewegung des Mechanismus selbst ist; die vollständige Anfügung an seine Bedürfnisse und Erheischnisse." (MEGA II.3.6.:2016)

Simple cooperation and division of labour get totally transformed once machinery becomes the main way of producing:

> "Wir kommen nun zu dem auf einem System der Maschinerie beruhnden mechanischen Atelier. Hier findet natürlich Theilung der Arbeit statt... Sie hat ihre materielle Basis, an den verschiednen, specificirten Maschinen... Hier im mechanischen Atelier besteht der Körper dieses Gesammtmechanismus aus den differenzierten Maschinen selbst... Es ist hier nicht ein besonders entwickeltes Arbeitsvermögen, das sich als Virtuose des besondren Instruments bedient, sondern es ist das selbst agirende Instrument, das ihm besonders und beständig attachirter Diener bedarf." (MEGA II.3.6.:2020, second emph. mine).

In the system of manufacture, the tasks are distributed according to a hierarchy of skills and powers. Specific physical and mental

abilities of individuals are seized upon and developed in their one-sidedness in order to produce a common, general mechanism (cf. MEGA II.3.6.:2020). By contrast, in the mechanic atelier[208] there no longer exists a hierarchy of abilities; instead, we have a general nivellement of services with the consequence that the workers can work at different machines with little prior training time. In Capital, he states that the proportion of skilled to unskilled workers has been completely reversed. In contrast to manufacture, where an "organised group" of workers formed the workforce, modern industry has an "essential division" between "workmen who actually employed the machines ... and into mere attendants of these workmen... In addition to these two principal classes, there is a numerically-unimportant class of persons, whose occupation it is to look after the whole of the machinery and repair it from time to time; such as engineers, mechanics, joiners, & c." (Capital 1:396).

The division of labour changes its character: in the system of manufacture it is the division of specialized abilities; in the mechanic atelier, it is the division of specialized machines, under which the various groups of workers are distributed. "Es ist mehr Verteilung der Arbeiter unter specialisirte Maschinen als Theilung der Arbeit unter specialisirte Arbeitsvermögen..." (MEGA II.3.6.:2021; see also Capital 1:396). This is what Marx meant when he said above that the mechanic atelier "overthrows the essential principles of manufacture, which was based on the division of labour." (MEGA II.3.1.:294). In a letter to Engels, Marx asked for an empirical confirmation of Ure's claim that the

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208 In the Manuscripts, Marx often uses this term to denote the new technological character of the post-manufacture age. In Capital he calls it automatic factory, or, more generally, "Modern Industry".

division of labour (as described by A. Smith) was a characteristic trait of manufacture, rather than modern industry.[209]

Under manufacture, the construction of new instruments had to be done with respect to human abilities and characteristics:

> Erstens also wird das Arbeitsvermögen dieser besondren Operation angeeignet. Zweitens aber, da die Basis der Operation selbst der menschliche Körper bleibt, findet statt, wie Ure sagt, daß diese Appropriation zugleich 'distribution, ou plutot l'adaptation des travaux aux differentes capacites individuelles.' D.h. die Operationen selbst werden den natürlichen und erworbenen Fähigkeiten angepaßt in ihrer Trennung. Es ist nicht Auflösung des Processes in seine mechanischen principes, sondern eine Auflösung mit Rücksicht darauf, daß diese einzelnen Processe als Functionen menschlicher Arbeitsvermögen ausgeübt werden müssen." (MEGA II.3.1.:274) .

Modern industry, on the contrary, is characterized by the principle that machines get constructed under the sole influence of scientific analysis and natural laws. Marx echoes here a central theme from the work of Andrew Ure who stressed that machinery is preferable for factory-owners because it is not dependent on the skills of craft workers. Another point is that Marx repeats Ure's judgement that modern industry has eliminated the division of labour.[210]

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209 "For my book I need an example showing that, in mechanical workshops, the division of labour, as forming the basis of manufacture and as described by A. Smith, does not exist. The proposition itself has already been set forth by Ure." (Letter to Engels, 6.3.1862)

210 See Berg (1982:197-8) With respect to the relation between Babbage and Ure she writes: "Cardwell has described Ure's Philosophy of Manufacturers as a fairly obvious imitation of Babbage with some insight into the automatic factory. But,

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Consider, now, the discussion in Capital. Marx repeats the general line of argument, but changes his evaluation completely: now he sharply criticises the division of labour under the system of manufacture, drawing on Ferguson and Smith:

> [The division of labour in manufacture] "increases the social productive power of labour, not only for the benefit of the capitalist instead of that for the labourer, but it does this by crippling the individual labourers." (Capital 1:344).
>
> "In manufacture, as well as in simple co-operation, the collective working organism is a form of existence of capital... manufacture proper not only subjects the previously independent workman to the discipline and command of capital, but, in addition, creates a hierarchic gradation of the workmen themselves. While simple co-operation leaves the mode of working by the individual for the most part unchanged, manufacture thoroughly revolutionizes it, and seizes labour-power by its very roots. It converts the labourer into a crippled monstrosity, by forcing his detail dexterity at the expense of a world of productive capabilities and instincts; just as in the States of La Plata they butcher a whole beast for the sake of his tide or his tallow." (Capital 1:340, my emph.)

...

in fact, Ure took pains to distinguish himself from Babbage. He rejected the principle of the division of labour as the significant feature of the factory, and referred to Babbage by implication when he argued that the "scholastic dogma of the division of labour into degrees of skill has been exploded by our enlightened manufacturers". They are "better acquainted with the general economy of the arts, and better qualified to analyze them into their real principles, that the recluse academician can possibly be, who, from a few obsolete data, traces out imaginery results, or conjures up difficulties seldom encountered in practice"." (Berg 1982: 197-8; the Ure-quote is from The Philosophy of Manufacturers at p.23-4).

Modern industry, on the other hand, he now sees more positively: it is more productive than manufacture, since it is not dependent on a certain number of skilled craftsmen and their skills. Instead, an objective productive organism, a "skeleton", takes their place. The 'subjective principle' of adapting the instruments to personal abilities, falls away. The production process gets analyzed in its constitutent parts.

> "In manufacture, it is the workman who, with their manual implements, must, either singly or in groups, carry on each particular detail process. If, on the one hand, the workman becomes adapted to the process, on the other, the process was previously made suitable to the workman. This subjective principle of the division of labour no longer exists in production by machinery. Here, the process as a whole is examined objectively, in itself, that is to say, without regard to the question of its execution by human hands, it is analyzed into its constituent phases; and the problem, how to execute each detail process, and bind them all into a whole, is solved by the aid of machines, chemistry." (Capital 1:359)[211].

In Capital, he judges the possibilities for a broad development of individuals to be better on the basis of machinery. In the Manuscripts and Capital, he suggests that the division of labour belongs to the period of manufacture; that modern industry with the dominance of machine production, has eliminated division of

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211 Cf. also the following passage: "The principle which it pursued, of resolving each process into its constituent movements, without any regard to their possible execution by the hand of man, created the new modern science of technology. The varied, apparently unconnected, and petrified forms of the industrial processes now resolved themselves into so many conscious and systematic applications of natural science to the attainment of given useful effects." (Capital 1:456-7) See also Capital 1:434 and 567.

labour. However, this refers only to the division of labour inside the factory.

To illustrate the different character of the means of production, Marx uses the metaphor of "dwarf-instruments", (Capital 1:361), as being characteristic for manufacture, whereas "cyclopic machines", or even "cyclopic monsters", (Capital 1:360,364), are characteristic of modern industry. This indicates that, although monsters may be more horrible than dwarfs, neither is immediately preferable: dwarfs and monsters are both weird figures for humans. More important is Marx's juxtaposition of the social character of labour in these two technological epochs. In manufacture the worker is expropriated of his skill which becomes in turn embodied in the "Gesamtarbeiter":

> "Intelligence in production expands in one direction, because it vanishes in many others. What is lost by the detail labourers, is concentrated in the capital that employs them... In manufacture, in order to make the collective labourer, and through him capital, rich in social productive power, each labourer must be made poor in individual productive powers." (Capital 1:341)

We are wrong if we think that machinery also displays this feature:

> "Machinery... operates only by means of associated labour, or labour in common. Hence the co-operative character of the labour process is, in the latter one, a technical necessity dictated by the instrument of labour itself." (Capital 1:364-5)[212] .

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212 The English translation does not render the following interesting connotation: as the German original says machinery "funktioniert nur in der Hand unmittelbar vergesellschafteter oder gemeinsamer Arbeit", (Kapital 1:407). Now, this is the same formula that Marx employs when describing a

This is the complete reversal of the argument in the Manuscripts. To avoid misunderstanding: in the Manuscripts Marx also emphasizes the point that machine production leads to higher productivity, and that the labour process becomes social. Large-scale production seems irreconcilable with single ownership of the means of production:

> "Das positive Resultat hier, daß die Arbeitszeit fällt, deren bedurft wird, um vergrösserte Masse von Lebensmitteln zu produciren, daß dieß Resultat durch die gesellschaftliche Form der Arbeit erreicht wird und daß der Besitz des Einzelnen an den Productionsbedingungen nicht nur als nicht nöthig, sondern als unvereinbar mit dieser Production auf großer Stufenleiter erscheint ... Sobald diese gegensätzliche Form wegfällt ergiebt sich also, daß sie [die Arbeiter, R.G.] dies Productionsmittel gesellschaftlich, nicht als Privatindividuen besitzen." (MEGA II.3.6.:2144, my emph.).

The fact that the workers are still fragmented, and developed only in narrow specialities, he considers to be an inheritance of manufacture, which is, however, enhanced by capitalist use of machinery (see Capital 1:398).

The decisive difference between the Manuscripts and Capital is the fact that according to the Manuscripts the worker under the system of manufacture is in full possession of his knowledge and skill, that it is him, the human being, who commands the instrument;

...

decisive feature of communist society, viz. that labour would be social from the outset ("unmittelbar vergesellschaftet"), whereas in capitalism the social character of production does prove itself only post festum, after the exchange of private products. It is no accident that Marx assimilates the character of work under Modern Industry to a feature of communist society.

modern industry, on the contrary, is the most perverted form of capitalist technology (i.e negative in comparison to manufacture):

> "Diese Specialität der Passivität [An- und Unterordnen unter die Operationen der Bewegungen der Maschine selbst, R.G.], d.h. die Aufhebung der Specialität selbst als Specialität characterisirt die Maschinenarbeit. Die Verbesserungen innerhalb des mechanischen Ateliers selbst darauf gerichtet alle Virtuosität, wieder auf seiner eigenen Basis hervorgewachsen, möglichst zu entfernen. Es ist also ganz einfache Arbeit, d.h. ihre Einförmigkeit, Inhaltslosigkeit und Unterordnung unter die Maschine. Tödtende Arbeit, als Arbeit, die wie bei der Theilung der Arbeit in der Manufactur, völlige Subsumtion des Individuums unter sie erheischt. Sie verhindert die Entwicklung der Specialität, specialisirt aber selbst wieder diese Specialitätslosigkeit. Die letzte Selbstbefriedigung des Arbeiters in der Arbeit fällt hier fort, absolute Gleichgültigkeit, die durch ihre Inhaltslosigkeit selbst bedingt wird... Bei der Manufactur ist die Arbeit continuirlich. Im mechanischen Atelier ist die Aufmerksamkeit auf die Arbeit der Maschine continuirlich, und die durch ihre Bewegungen ... bedingte Bewegung des Arbeiters. Sein wirkliches Eingreifen dagegen zufällig, je nachdem die Maschine einen error begangen oder nicht." (MEGA II.3.6.:2021-2).

Marx reverses his judgement in Capital. He now conceives manufacture, as we have seen, as the technological regime which expropriates the workers from their skills, cripples their individualities etc. Likewise, he conceives Modern Indurstry as a turning point, as a mode of production in which the character of labour is already unmittelbar gesellschaftlich, "cooperative". The virtuosity, knowledge, and skills are embodied in the Gesamtarbeiter, albeit belonging to capital. On the basis of this construction it is sufficient to expropriate capital in order to return the lost capacities to the Gesamtarbeiter.

An additional point is of interst here. Marx said that the co-operative character of the labour process is a "technical necessity" (see Capital 1:365). This suggests that he adheres to a sort of "technological primacy". First develop technologies, then social institutions. This standpoint makes is easy to present the trend towards communism as "inevitable", or "lawlike".

Technological determinism was a very appealing concept for Marx because it offered him the chance to prove the inevitability of communism. Every time he analyses the role of technology in history, he is tempted to endorse a determinist view, no matter if we take the The Poverty of Philosophy, the Manuscripts 1861-3, or Capital. However, in the Manuscripts, Marx is left with the most discomforting theoretical problems which spring from his insistence on the central role of machinery and its de-humanizing effects. Therefore, he makes little reference to the technological base of communism, which, after all, seems the most interesting question, given his evolutionary approach to technology and social institutions. In Capital, he solves this problem by stressing the cooperative character of the labour process as the decisive feature of modern industry, thus suggesting a "genetic link" with communist society. Using a distinction of Agnes Heller, we may say that Marx did not rely on the "subjective will" to bring about a higher form of society; he was not content until he could find some "natural laws" providing the possibility for transition.

CHAPTER 4: HISTORICAL MATERIALISM

> All earlier modes of production were essentially conservative.
>
> Karl Marx

4.1. Productive forces and mode of production

Marx's interest in technology, stated time and again in this work, stems from his materialist approach to studying society. As he stated in Capital 1:

> Technology discloses man's mode of dealing with nature, the process of production by which he sustains his life, and thereby also lays bare the mode of formation of his social relations, and of the mental conceptions that flow from them. (Capital 1:352).

In this statement, a relationship between three elements is expressed: (1) the transformation of nature; (2) forms of social relations; and (3) mental conceptions.[213] These three elements have been evident in Marx's work since the early German Ideology.

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213 As Douglass North put it: "Marx's overall analysis, set in the context of economic history, explores human interrelationships as a vehicle for studying the increasing mastery of humans over nature. The growth of the productive forces of human beings was an ongoing process in the subordination of nature to man. As humans learned how to produce and use intermediate goods, it became necessary to define the relationship amongst human beings with respect to the production and use of these tools." North (1986:58).

In the canonical 1859 Preface, Marx states the following relationship between these elements:

> "In the social production of their life, men enter into definite relations that are indispensable and independent of their will, relations of production which correspond to a definite stage of development of their material productive forces. The sum total of these relations of production constitutes the economic structure of society, the real basis, on which rises a legal and political superstructure, and to which correspond definite forms of social consciousness. The mode of production of material life conditions the social, political and intellectual life process in general. It is not the consciousness of men that determines their being, but, on the contrary, their social being that determines their consciousness. At a certain stage of their development, the material productive forces of society come in conflict with the existing relations of production, or - what is but a legal expression for the same thing - with the property relations within which they have been at work hitherto. From forms of development of the productive forces, these relations turn into their fetters. Then begins an epoch of social revolution." (CW 29:263).

My discussion has so far shown that Marx's main critical concern was to investigate the conditions for realising the 'good life'. To this end, he was interested in the liberating potential of technologies and social forms. As to the former, we already have seen in chapter 3 that Marx was able to conceive of problems which stem from man's dealings with nature. From this he did not conclude that it is the fault of technology as such (or of a specific, dominating attitude towards nature). I think he was right to reject such a conclusion. As to the latter, he concluded that the negative sides of technology only stem from its capitalist employment: in so doing I think he was wrong. He did not conceive of the possibility that specific forms of technology

would cause ecological problems for every social form, not only for capitalism.

The present chapter takes up again the subject of chapter 3; this time, however, from the specific viewpoint of G.A. Cohen's analysis. I first discuss Cohen's interpretation of Marx's historical materialism, concentrating on two main questions: (1) the question of the Development and Primacy Theses; (2) the methodological question, i.e. Cohen's proposed functional explanation (4.1. and 4.2.). My theoretical interest is the following: while agreeing with Cohen (against Elster) that game theory cannot replace functional explanation within historical materialism (or even within the social sciences), I do not agree completely with Cohen's way of posing the problem nor with his solution. I shall propose not only a revision of the Development and Primacy theses and the functionalism they seem to imply but also a reformulation of this set of questions in a way which takes into account ecological arguments (4.3. - 4.5.).

4.2. Productive forces and historical materialism

The economic historian Douglass North asserts that Marx's "historical materialism" still deserves serious attention:

> "The complex interrelationships between the productive forces of an economy, the property-rights system of an economy, and the political structure are clearly at the heart of the dilemma of all economies through time in respect of the ability to realize the potential of an economic society. It was Marx's genius to realize that this was the heart of the issue and ... he provided us with brilliant clues to

it." (North 1986:63)[214]

G.A. Cohen's Karl Marx's Theory of History (KMTH for short) is undoubtedly one of the most ambitious contemporary efforts to analyse the relation between productive forces, relations of production and social superstructures. The basic argument of the book is the claim that Marx was committed to the following pair of theses: "(a) The productive forces tend to develop throughout history (the Development thesis). (b) The nature of the production relations of a society is explained by the level of development of its productive forces (the Primacy Thesis proper)" (Cohen 1978: 134). As to the latter, Cohen comments: "The primacy thesis is that the nature of a set of production relations is explained by the level of development of the productive forces embraced by it (to a far greater extent than vice versa)... The primacy thesis ... implies that changes in productive forces bring about changes in production relations" (Cohen 1978:134-5).

Cohen's technological interpretation of history draws a sharp distinction between (asocial) productive forces and (social) relations of production. The development thesis claims that there is a tendency for the productive forces to develop; the primacy thesis claims that the relations of production are explained by the level of the productive forces; and the superstructure is explained by the character of the productive relations. But this is only half of the story. The other half is that the superstructure stabilizes the productive relations and the productive relations are propitious for the productive forces. Both parts of the argument are made compatible by means of a functional explanation

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214 North's own approach, it is worth noting, builds upon the transactions-cost approach.

(see below).[215]

The reader will notice that I equate productive forces with technology, an equation which is basically true for capitalist societies. It seems that size and density of population played an equivalent role in precapitalist societies. With capitalism, it is clearly technology. As Marx put it in the Grundrisse:

> "This still without regard to the fact that increase in population increases the productive force of labour, since it makes possible a greater division and combination of labour..." (Grundrisse:400).

> "The greater the extent to which production still rests on mere manual labour, on use of muscle power... the more does the increase of the productive force consist in their collaboration on a mass scale... Capital, in its true development, combines mass labour with skill, but in such a way that the former loses its physical power, and the skill resides not in the worker but in the machine and in the scientific combination of both as a whole in the factory." (Grundrisse:529).

After an exegetical demonstration which is supposed to show that Marx was committed to both the Development thesis and the Primacy thesis, Cohen goes on to assert the pair of claims as true. As to the validity of the development thesis, he admits that his defence is "not conclusive, but it may have some substance." (Cohen 1978:151). The defence contains "two facts about human nature, and one fact about the situation human beings face in history." (Cohen 1978:150) The first fact about human nature is (c) that "men are, in respect to be specified, somewhat rational." The historical

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215 In an exchange with Elster, Cohen revised his position and claimed that it is not functionalism which lies at the basis of historical materialism, but consequence explanations. For the difference, see Cohen (1982:35-42).

situation (d) of men "is one of scarcity." The second fact about human nature is (e) "that men possess intelligence of a kind and degree which enables them to improve their situation." (Cohen 1978:152). As we have seen, (d) is not universally true. Marx envisages two possible points of departure for mankind: one in which "the free gifts of nature [were] abundant" (Grundrisse: 612) and little pressure existed to develop technologies.[216] The other possibility is that the natural circumstances are such that men have to wrestle with nature in order to obtain a living. (e) denotes the fact that mankind uses technologies in order to transform nature.

Cohen acknowledges that his defence has two large gaps: "The first is that (d) does not disclose the relative magnitude of man's material problem and consequent interest in its solution, by comparison with other human problems and interests. Perhaps certain cultural and social possessions are worth a great deal of material sacrifice, in the calculus of human welfare." (Cohen 1978:153) I return to this in 4.5. But even supposing that this point favours his case, the argument would not be complete, "[f]or it is not evident that societies are disposed to bring about what rationality would lead men to choose. There is some shadow between what reason suggests and what society does" (Cohen 1978:153). Marx himself seemed to assume that "the gulf between the demands of reason and the actual tendency of history" is filled by maintaining "a rough correspondence of interests between ruling classes and humanity at large" (Cohen 1978:153). Cohen, however cannot accept this claim for solving his difficulty (i.e. filling the gulf between reason and reality), because "the claim is closely

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216 However, an increase in the size of population may alter this state.

related to the primacy thesis (b), and it is our intention to use (a) as part of the argument for (b)" (Cohen 1978:153).

Cohen now brings to bear "a striking historical datum: that societies rarely replace superior productive forces by inferior ones" (Cohen 1978:150). Cohen takes this broad generalization to give additional power to the somewhat unstable claims (c) to (e). This is so, because "good productive forces do not yield to less good ones, in the normal run of things... [y]et productive forces are frequently replaced, by better ones" (Cohen 1978:154). For this reason, statements (a) to (e) help to explain the discrepancy between the rarity of regression and the frequency of progress.

Let us now turn to the validity claim of the primacy thesis. Cohen offers two arguments in defence of it. The first is "that a given level of productive power is compatible only with a certain type, or certain types, of economic structure. Slavery, for example, could not be the general condition of producers in a society of computer technology, if only because the culture needed in labourers who can work that technology would lead them to revolt, successfully, against slave status" (Cohen 1978:158)[217]. The second is that Cohen is not content, as many Marxists are, to state a certain constraint which the productive forces impose on the relations of production. In his view, such an attitude is unsatisfactory, "[f]or the constraint is symmetrical.[218] If high

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217 As Marx remarked, "Don Quixote long ago paid the penalty for wrongly imagining that knight errantry was compatible with all economic forms of society." (Capital 1:86 fn)

218 Note that under this premise no determinism is implied. As Cohen himself emphasizes, he does not discuss determinism, but "only" the question of primacy: how do changes in productive forces and relations of production affect each other when they do?

technology rules out slavery, then slavery rules out high technology" (Cohen 1978:158).

As Cohen puts it, "[w]e may argue for (b) on the basis of (a) and the facts of constraint. (a) says that the productive forces are disposed to develop. Given the constraints, with sufficient development of the forces the old relations are no longer compatible with them" (Cohen 1978:158). Hence they will be replaced along with the development of the productive forces or, if they resist, after a time-lag contradiction obtains. This contradiction, however, can only be solved by an adaption of the relations of production to the forces of production, not vice versa.

I am aware that this summary of Cohen's main argument is a very condensed one but I hope that it will suffice for the following discussion. Since I think that Cohen's approach does contain very valuable elements for my study, I shall look a little more closely at his assumptions and definitions, especially in the light of some criticisms made against it.

The criticisms I am dealing with have concentrated on the following main propositions of the book: (a) the development thesis; (b) the primacy thesis; (c) the rationality assumptions; (d) the methodology implied.[219]

Since the rationality assumptions are sine qua non conditions for the development thesis (which in turn is necessary for the primacy thesis), I shall start with the development thesis and the implied problem of rationality. To anticipate the result of my discussion, I should say that in my view the central flaw in

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219 See the debate in Political Studies, Inquiry, Journal of Philosophy, and Analyse & Kritik.

Marx's 1859 Preface (and thus in Cohen's defence of it) is that its basic notions cannot be defined independently of one another.[220] This becomes clear also in Cohen's own treatment where he fails to provide an asocial explanation of the tendency of the productive forces to develop.[221] My own proposal draws on evolutionary and systems theory. I do not object to the development thesis generally but reject it on the grounds which have been put forward in its defence. It follows equally that the Primacy thesis has no place in my theoretical framework.

4.2.1. Productive forces and rationality

Cohen's strategy to give the 1859 Preface a consistent shape, and thus to defend it, is basically the following. Productive forces tend to develop autonomously, without the influence or "help" of social relations. This operation is designed to avoid the crucial problem of mixing the explanans with the explanandum.[222] For Cohen everything depends on the possibility of such an analytical separation. If he does not succeed in showing that there is an autonomous tendency for the productive forces to develop, if he has to

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220 My criticism is thus complementary to the one of Lukes who denies the possibility of constructing relations of production independently from the superstructure in a "rechtsfrei" manner - see Lukes (1982).

221 We can detect a similar problem in Habermas' theory. He distinguishes between instrumental and communicative action and assumes that the former can take place without the latter. See Krahl (1971:393) for a critique.

222 Cf., also, Marx, who refers to "a dialectic of the concepts of productive force (means of production) and relations of production, a dialectic whose boundaries are to be determined, and which does not suspend the real difference" (Grundrisse:109).

take recourse to social factors which explain this development, then his explanation becomes circular.

Cohen defines productive forces in the following way: they include labour power, raw materials, instruments of production, science, spaces and premises (cf. Cohen 1978:40-55).[223] Since Marx never provides a list of productive forces, his discussion is based "partly on scattered remarks and partly on general theoretical considerations" (Cohen 1978:42). But in Cohen's list at least labour power and science are social notions; hence if the tendency of the productive forces to develop hinges upon these factors, this development cannot be explained in asocial terms. Consider first the use of labour power. As Cohen himself asserts, "the development of the productive forces is very largely the growth in knowledge of how to control and transform nature, and that <u>is</u> a development of labour power" (Cohen 1978:41). One must avoid thinking of the owners of this labour power, i.e. the immediate producers, as isolated individuals. As became clear in chapter 2, no such methodological individualism can be imputed to Marx's philosophical anthropology. Knowledge and skills exist and can be promoted only in social context. One of the main instances of growth in productive forces is, according to Marx, population growth, cooperation and division of labour, issues typically missing from Cohen's account. Cohen concedes that cooperation might be necessary for the actual development of productive forces (and if it were so, cooperation will occur) but denies that it is necessary for the <u>potential</u> development of the productive forces: "Relations might possess the potential to develop the forces in the sense that if cooperation with them is forthcoming, they will

223 Contrast here Habermas' nearly completely non-material definition, Habermas (1976:152-3).

do so: cooperation is evidently not necessary to their possessing that potential" (Cohen 1983a:210).

But compare this statement with Marx's insistence that men always produce in a cooperative way:

> "In production, men enter into relation not only with nature. They produce only by co-operating in a certain way and mutually exchanging their activities. In order to produce, they enter into definite connections and relations with one another and only within these social connections and relations does their relation with nature, does production take place." (CW 9:211, my emphasis; see also GR:84, 529).

But let us see how Cohen tries to adduce evidence for his claim. Cohen distinguishes between (1) "an autonomous tendency for the productive forces to develop" and (2) "a tendency for the productive forces to develop autonomously" (Cohen and Kymlicka 1988:177). The former does not refer to any social factors whereas the latter does. In order to support his asocial explanation, Cohen assumes a basic rationality operating on the level of isolated human individuals which leads them to increase their productive power.[224]

Two main objections have been made to this position, to which I now turn: one doubts the correspondence of the theory with the

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224 Cohen illustrates the difference between the two statements with the following metaphor: "A child has an autonomous tendency to grow up. He is born with a disposition to do so which is not externally instilled in him by, for example, his parents. But it does not follow that he has a tendency to grow up autonomously, where that means independently of parental and other assistance. The asserted autonomy of the tendency of productive power to grow is relevantly similar." (Cohen and Kymlicka 1988:177).

empirical facts, the other argues that the whole account is caught in circularity.

Levine and Wright have objected that the rationality assumptions do not concord with the historical facts. Cohen and Kymlicka concede: "The picture unintentionally suggested by KMTH is of individual producers, or cooperating groups of them, striving to upgrade their skills and means of production, so that labour will lie less heavily upon them, a picture in which global productive progress is the aggregate result of those several strivings." (Cohen and Kymlicka 1988:175).[225] Levine and Wright have called this the Rational Adaptive Practices (RAP) and have claimed that it is has been falsified by the known record of history; it was not the material situation of the producers but class-specific rationality what brought about development. (Levine and Wright, 1980) But if the RAP account is empirically false, the basic strategy of Cohen, i.e. to distinguish an autonomous tendency of the productive forces to develop from social forms which are favourable to that development, fails. Cohen acknowledges this challenge: "The upshot is a dilemma. Either (i) maintain a RAP account of the development thesis, thereby preserving the autonomy of the tendency to development, and enabling a non-circular derivation of the primacy thesis, the entire procedure however, resting upon an empirically false premiss; or (ii) adopt an empirically defensible "class-specific rationality" interpretation of the development thesis [as Levine and Wright do, R.G.], but then the autonomy of productive development is lost and the attempt to infer the primacy thesis involves a vitiating circle." (Cohen and Kymlicka, 1988:176).

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225 Strictly speaking, the "cooperating groups" are not admitted by Cohen's claim that the tendency for the productive forces to develop has to be explained in an asocial way.

According to him, the productive forces are not "unmoved movers", but moved by human beings. As has been shown above, Cohen needs an asocial historical force in order to make his argument work. But basic to the RAP account is a model of human individuals as isolated beings. This seems neither to be a valid historical assumption nor to express Marx's view in this case.

Recall the discussion in chapter 2, where human beings were defined as biological and social beings. Cohen now must assume that human beings already show on the biological level the capacity to improve their material situation i.e. animal laborans instead of animal sociale. For Marx this would obviously be a nonsensical statement. For him, humans always produce together with others; the isolated individual is an abstraction which he ridiculed time and again. To make it plain: the very activity of producing is a social activity.

That for Marx the biological and the social dimension were inextricably linked together has been shown several times in this study. Consider here only Marx's example of the architect: no architect exists in isolation; he has the characteristic of being an architect courtesy of a social group which assigns to him the position and profession he has.[226]

William Shaw has rejected the legitimation of such a criticism of Cohen's theory. He holds that Cohen's generalization as expressed in the development thesis is a "generalization about human society and not a claim about each individual's motivation... The claim that men's productive forces tend to

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226 It is worth noting that on the basis of the RAP account Cohen's theory employs a form of methodological individualism.

develop does not entail that each man tends to develop the productive forces" (Shaw 1986:203). But in this formulation the crucial question is still unanswered: where does the tendency of the productive forces to develop come from? Shaw seems to propose an explanation on the level of "aggregate individuals"; not each and every individual is productivity-enhancing, but an overall result of their common striving is such. Now this is either an explanation on the level of methodological individualism and can be illustrated with invisible hand mechanisms (cf. Buchanan 1983:426), or it relies on the social dimension of human productive activity. The first possibility is explicitly rejected by Shaw, whereas the second would run counter to the self-imposed condition to explain the tendency of the productive forces to develop in asocial terms.

But G.A. Cohen has changed his mind on this issue: he has rejected the RAP account explicitly. Cohen now presents a non-RAP view, building on a statement of Philippe van Parijs (Cohen and Kymlicka, 1988; see van Parijs 1984:96). This new claim reads as follows:

> "[B]eing rational, people retain and reject relations of production according as the latter do and do not allow productive improvement to continue... [T]he non-RAP claim does not posit a 'search and selection process which operates directly on the ... productive forces' but 'one which operates on the relations of production, which in turn control the search-and-selction of productive forces.' .. This non-RAP reading of the argument for the development thesis preserves the autonomy of the tendency of the forces to develop. The tendency is not now seen as an effect of the "class-specific rationalities" attached to given sets of social realtions; on the contraray. Particular class-specific rationalities prevail only as long as they are associated with class structures that serve a

> more basically grounded impulsion to productive progress." (Cohen and Kymlicka, 1988:178)[227]

The last sentence in this passage only confirms verbally a position from which nothing is left. Here the productive forces develop because of a specific rationality on the level of social relations. This is a far better account than the RAP account; but this one seems to fall into the trap of cicularity. This is so because the burden of explanation is shifted from the productive forces to social relations, hence a social argument enters the premiss of the development thesis. The structure of his model changes drastically as soon as Cohen transfers the rationality from the asocial to the social level: now the rationality operating within social relations becomes crucial for the explanation of the development of the productive forces. However, this is the complete reversal of his initial claim i.e. to explain social relations by asocial productive forces.

But Cohen does not seem ready to accept such a critique. Instead, building on the distinction between (1) an autonomous tendency of the productive forces to develop and (2) a tendency of the productive forces to develop autonomously, he might wish to

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227 Jon Elster also questions the validity of the development thesis. He summarises Cohen's account in the following way: "The argument assumes (i) that progress is in the interest of humanity, (ii) that there always is some social class whose interests coincide with the interest of humanity in general and (iii) that this class will get the upper hand in the class struggle... For this broad statement no other argument is given than that 'there is a general stake in stable and thriving production, so that the class best placed to deliver it attracts allies from other strata in society.' (p.292) This, I submit, simply is not true; the general interests of society do not create their own fulfilment." (Elster 1980:124).

attribute the rationality mechanism to (2) and to limit himself to an abstract statement of the sort that productive forces tend to develop, just like children have the tendency to grow taller. But if this remains the essential and final arguement, the criticism of Elster is still valid: "Still there are many children, but only one history of the world, and I do not believe that Cohen really means to hedge his argument to the extent of imputing only counterfactual implications to his thesis." (Elster 1980:124)

This should make clear that a strategy of demonstrating an asocial tendency of the productive forces to develop is bound to fail. My own reconstruction of Marx consequently does not assume an autonomous tendency of the productive forces to grow, but a process of co-evolution of productive forces and social institutions. Productive forces are at every point in their development influenced by the social form in which they operate. This statement reflects on a social level what is already contained in Marx's philosophical anthropology: it belongs to the very nature of humans that they are social beings.

As will become clear in a moment, Marx was far from looking for RAP mechanisms to support his outline. Quite the contrary, his analysis starts on the level of social relations. The starting point is the degree to which the division of labour has set apart town and country, commerce and industry, manual and mental labour, branches of industry, and has brought about means of transport and communication which connect virtually every local group with everyone else (world market).[228] Marx explains the important point of transition from feudalism to capitalism by contingent facts:

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228 Sometimes, above all in the early writings, Marx conceives the separation between the two classes of capitalists and workers also as a form of division of labour.

the existence of mechanical sciences, money capital, machines and free labour. All these factors merged under specific historical circumstances. Once this had occurred, a self-sustaining and self-replicative process was set in motion: capitalism reproduced itself on an ever larger scale, driving out all other modes of productions (or pushing them into niches). Joshua Cohen expresses a similar view when he writes:

> "But surely, it will be said, there has been productive progress, and the blockages considered, whatever their longevity, were impermanent. The problem is that the force of this objection derives from focussing on capitalism and its tendency to expand into noncapitalist regions. What is specific to capitalism is precisely that the economic structure ties interests to productive growth and distributes power so that these interests are more likely to be satisfied than in noncapitalist forms. Specifically, competition among producers provides a strong interest in productivity-increasing strategies, and the existence of a labor market makes it more difficult for labor to block these strategies..." (Joshua Cohen 1982:270).

G.A. Cohen claims that the development thesis holds true for the whole of history; I agree with Joshua Cohen and Elster (1980: 124) that it essentially holds true for capitalism. I think Marx was right in separating capitalism from all previous modes of production in so far, as the previous modes are closer to each other (in respect of economic efficiency) than to capitalism: "All earlier modes of production are essentially conservative".[229]

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229 Capital 1: 457; see also the reference to the Communist Manifesto (MEW 4:465), made by Marx on the same page. In an illuminating article Welskopf pointed out that the progress in the development of productive forces was a historically discontinuous one. The peaks of development "jumped" over the globe: from Asia and Northern Africa to the Mediterre-

I turn now to the second major problem. The danger of circularity has been spelt out in an even more penetrating criticism by Joshua Cohen (1982). For Joshua Cohen, there seems to be no way out of this trap, except by endorsing an additional argument, a "subargument" or "striking historical datum", as G.A. Cohen calls it. "Its premiss... was that societies frequently replace productive forces by better ones, and only very infrequently by inferior ones." (Cohen and Kymlicka, 1988:185; see also Cohen 1978:150). Joshua Cohen calles this claim the "Alleged Facts" and provides some empirical counterevidence (see Joshua Cohen, 1982:266-9). In contrast to G.A. Cohen he claimes that history displays frequent regression and stagnation of productive forces. Cohen and Kymlicka in turn pointed out that one has to distinguish between "actual and potential output per person, and between technical progress and productive progress in a comprehensive sense." (1988:190) I think that these "conceptual clarifications" are rather evasive: they no longer offer good criteria for supporting the "Alleged Facts". Take the example of China. G.A. Cohen might wish to argue that Chinese society developed productive forces because they provided the possibility of increasing the potential output per person. Taking for granted such an argument, I simply object that this is no longer "a striking

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nean (Antiquity), Europe (feudalism and emergence of capitalism), North America (capitalism) to the countries of Eastern Europe and Asia (socialism). No region of the world occupied the peak in two epochs which followed each other; see Welskopf (1974). Compare here also Gould who wrote with respect to biological evolution: "[T]he evolutionary transition from any level to the next occurs more than once; the advantages of increased complexity are so great that many independent lines converge upon the few possible solutions. The members of each kingdom are united by common structure, not by common descent." (Gould 1973:117).

historical datum": in this case an inferior productive force has not been replaced by a superior one. Cohen might then argue that neither has the reverse been proven i.e. a superior productive force has not been replaced by an inferior one. But in so doing, Cohen offers an overdetermined account to support the validity of the Development thesis: on the one hand he claims that productive forces may sometimes have grown without giving rise to an actual increase in per capita income; on the other hand he claims that even if the productive forces stagnate, the Development thesis would not be invalidated, since even rare progress would then be sufficient to support his claim. [230]

To summarize: the foregoing discussion has shown that the development thesis cannot be defended in the way required by Cohen's premises. If we are ready to infer historical data, we enter a discussion about what are "normal" patterns of development for the history of mankind (see Shaw 1986:206). I do not think that we are to expect a clear answer to such a question. As Theda Skocpol, in her review of Barrington Moore's Social Origins of Dictatorship and Democracy, has claimed, any comprehensive study of social change has to take into account an intersocietal dimension. This is to say that an analysis which restricts itself to intrasocietal changes is bound to fail. As she put it,

> "the revolutionary methods of launching modernization ... could be interpreted in large part as attempts to maintain substantive national political sovereignity in a modernizing world dominated by the earlier "Bourgeois" (economic and/or political) modernizers ... Possibilities for continued industrialization and/or democratization in the wake of

230 Similarly evasive is Shaw's contention that only recent historical research has been interested in these questions, which would explain the weak form of an argument of Cohen's type, cf. Shaw (1986:205).

> 'bourgeois revolutions' are in part determined by international relationships and conditions..." (Skocpol 1973:32-3)

This shows indeed that an argument of this degree of simplicity and ambition (Cohen and Kymlicka 1988:175) does not work.

Many authors have maintained that technology is an autonomous force in history and that it evolves according to an inner logic. As I claimed in chapter 3, these views cannot be defended. We can speak of technology as having an evolution, but only an "apparent" autonomy: it is a heterogenous field of human and social practice which cannot be conceptualised on par with social systems. What can be observed is a differentiation of tools and increasing complexity. True, in capitalism this technological evolution is likely to be translated into increasing productivity, too. This is so because the very process of invention is linked to the economic system. But this fact is not sufficient to claim an autonomous development of technology: here it is defined by economic needs.

4.2.2. The spectre of functionalism

I now come to the methodological question. Cohen has been sharply attacked for employing functional analysis in explaining how the productive forces cause change in social institutions and, at the same time, social institutions exist because of their beneficial impact on the development of the PF. Cohen links the Development thesis and the Primacy thesis together using a functional explanation.

Jon Elster argued that it is close to impossible to find functional explanations in the social sciences. According to him it is essentially a method which yields good results in biology, but obscures the issues at hand in the social sciences. (Elster 1980:

125-6) This is so for the following reason: a functional explanation explains an event E as occurring because of its beneficial consequences for something else, (X). Or, in his words:

> "An institution or a behavorial pattern X is explained by its function Y for group Z if and only if:
> (1) Y is an effect of X;
> (2) Y is beneficial for Z;
> (3) Y is unintended by the actors producing X;
> (4) Y - or at least the causal relation between X and Y - is unrecognized by the actors in Z;
> (5) Y maintains X by a causal feedback loop passing through Z." (Elster 1983:57).

Now Elster claims that having described the beneficial consequences and the occurrence of Y, we do not have an explanation at all, unless we can show the existence of a feed-back-mechanism which secures that Y will indeed occur: "No one has any quarrel with functional explanation where the mechanism is actually shown to be at work. The hard question is whether one can ever be justified in setting forward a functional explanation even in the absence of a specific mechanism. In biology this question is to be answered in the affirmative, because the general mechanism of natural selection creates a presumption that beneficial consequences explain their own causes." (Elster 1980:126) According to Elster, social scientists unfortunately and typically do not satisfy all five conditions of the above list; and typically, what is missing, is the last condition.

Mary Douglas (1986) accepted Elster's demand, insisting at the same time that social sciences cannot do without functional explanations. In fact, she defends much of Durkheim's and Merton's programme, rejecting any naive ("arm-waving") functionalism. Cohen took another line of defence when he claimed that there are always mechanisms at work, even when we are not able to show them (see Cohen 1980:133-4). This epistemological point, however, offers us

little resistance against bad functionalist arguments of the type "whenever an event y has beneficial consequences it will occur." I thus take sides with Cohen in insisting on the importance of functional analysis for the social sciences,[231] but also accept Elster's demand that in order to have a proper explanation, we need to provide some sort of mechanism. Elster concludes that social scientists should be committed exclusively to causal and intentional explanations in order to avoid obscure or prescientific results. Elster would be prepared to accept a functional analysis if the mechanisms at work could be shown. Otherwise it would have the status of a metaphysical notion.

From the structure of Elster's five conditions and his comments one can conclude that he regards functional explanation as a variety of causal explanation, since he ties cause and effect in a very tight manner.[232] The only difference between a functional and a proper causal analysis would thus be the direction in which the causal chain is running.[233] But this premiss need not be accepted

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231 And, especially, his insistence that game theory cannot replace the central ssumptions of historical materialism. See also Berger and Offe: "Logically, the game starts only after the actors have been constituted, and their order of preferences has been formed as a result of processes that cannot themselves be considered as part of the game." (Berger and Offe, 1982:525).

232 Von Foerster (1984) coined the term "trivial machines" to denote the deterministic connection between input and output, where input is understood as sufficient condition for a certain output. One can easily see how this applies to a deterministic cause-effect relationship.

233 Cohen explicitly holds that functional explanations or "consequence explanations" (as he later calls them) are a variety of causal explanations - see Cohen (1980:130). Luhmann holds exactly the opposite position, as Berger and Offe rightly observed: "Luhmann surprisingly, but plausibly, sug-

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blindly. Another proponent of functional analysis clearly accepted the criticisms made by authors like Nagel and Hempel with respect to the "strong functionalist" paradigm. In 1962, Luhmann stated that "it is not immediately possible to explain causes by their effects." (Luhmann 1970:10, my transl.). The function of an action, seen as effect, cannot be taken to explain the factual occurrence of that action. Functional analysis thus needs some additional arguments which qualify these effects and functions. "The functional argument is not to conclude a specific need from an existing "service" [Leistung] and thus to justify the existence of this service." (Luhmann 1970:15, my transl.) So far, Elster and Luhmann could agree. But where Elster is sceptical that such "microfoundations" can be found (if not on the basis of methodological individualism and causal explanation), Luhmann is sceptical that a causal model will be possible at all, assuming that an uncertainty relation obtains between cause and effect. According to him, it is not possible to determine cause and effect simultaneously, for variables in social research typically cannot be separated. For Luhmann, the interesting question is thus not: Does A always cause B? but: Are A, C, D, E functionally equivalent to produce B? This approach opens up a space for alternative possibilities and a gain in knowledge. Luhmann consequently charges the "causal sciences" as metaphysics, since they try to fix action to invariant relations between determinant causes and determined effects (cf. Luhmann 1970:26). It seems that Luhmann's functional analysis does not claim the same <u>explanatory</u> power as

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> gests that we reverse the relationship of 'functionality' and 'causality'. In his view, functional relations are no longer a special subcase of causal relations, but causal relations a subcase of functional ones." (Berger and Offe, 1982:522).

Cohen's functionalist explanation (or any causal explanation in general); it is no accident that Luhmann avoids talking about "explanations". His concern is about functional equivalents which would give us more illuminating insights than strict causal connections (see also Berger and Offe, 1982).

In his Soziale Systeme, Luhmann seems to come close to Cohen's insistence that functional analysis may be a useful tool even in the case where micro-mechanisms cannot be shown to be at work, when he writes: "Der Erkenntnisgewinn [der funktionalen Methode] liegt gleichsam quer zu den Kausalitäten, er besteht in ihrem Vergleich. Man kann ihn erzielen, auch wenn Kausalitäten zunächst nur hypothetisch als noch nicht ausreichend erforscht unterstellt werden." (Luhmann 1984a:84) Die funktionale Methode ist "letztlich eine vergleichende Methode, und ihre Einführung in die Realität dient dazu, das Vorhandene für den Seitenblick auf andere Möglichkeiten zu öffnen. Sie ermittelt letztlich Relationen zwischen Relationen: Sie bezieht etwas auf einen Problemgesichtspunkt, um es auf andere Problemlösungen beziehen zu können." (ibidem, p.85) Larmore and others have objected to this view in that the relation between these functional equivalents is not clear and that arbitrary equivalents could be listed. Luhmann replied: "Dies trifft jedoch nicht zu. Entscheidend ist, daß die Hinzufügung durch den Problemgesichtspunkt begrenzt wird, so daß nicht Beliebiges, sondern nur Einiges und oft nur Weniges in Betracht kommt ... Die eigentliche Theorieleistung, die den Einsatz funktionaler Analysen vorbereitet, liegt demnach in der Problemkonstruktion. Daraus ergibt sich der Zusammenhang von funktionaler Analyse und Systemtheorie." (Luhmann 1984a:86). However, Luhmann is not as vulnerable as Cohen, since he does not accept the underlying claim regarding scientific research. At least from a footnote in Soziale Systeme, we can guess that for him it is not scientific explanation which is at stake, but the specific form of increasing and

reducing complexity (cf. id., p.85). According to him, mainstream science is fascinated by a parallel between the structure of theoretical statements ("Aussagestruktur") and the structure of the object ("Gegenstandsstruktur"). [234] In fact, Luhmann's decisive turn has been the adaptation of a constructivist epistemology. Cohen, on the other hand, shares the premisses of mainstream science which makes his position in the debate with Elster more vulnerable.

It is interesting to introduce Weber's analysis of religion here. Weber used the notion of "elective affinity" [Wahlverwandtschaft] to analyze specific social and cultural developments, such as the rise of Protestantism and capitalism. The term stems from chemistry and was taken up by Goethe who wrote a novel with that title.[235] But it was also known in philosophy where Kant employed the term "affinity". The "art of divorce" served him to separate

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234 For a criticism of the "natural science model" see also Charles Taylor, according to whom this rests on "the view that the natural sciences can provide us with paradigms for the methods and procedures of the social science. We think we understand the activity of exploring nature. Here, too, we are certainly over-complacent. But we tell ourselves a tolerably clear story of what goes on in natural science, and the very success of our research seems to indicate that we have here the norm for science in general. The prestige of this norm then stops further enquiry." (Taylor 1985:91-2). Without embarking on an exposition of the question if there are different sorts of scientific knowledge, we can propose two general solutions to the problem stated by Taylor: either we look for explanations sui generis in the social realm, or we stick to a "monist" view, rejecting, however, the realist epistemology which underpins the natural science model. In the latter case, both natural and social sciences construct their own object of knowledge.

235 Cf. Johann Wolfgang Goethe, Die Wahlverwandtschaften (1809); see Howe (1978:371).

the rational from the empirical.[236] Weber became familiar with Kant's philosophy via Kuno Fischer (see Howe 1978:377). A logical or analytical affinity was a "property of the concepts that they have certain features in common with other concepts", as the Encyclopädische Wörterbuch der kritischen Philosophie noted in 1797 (see Howe 1978:376). The classical definition was that of Bergman:

> "Suppose A to be a substance for which other heterogenous substances, a, b, c, &c., have an attraction; suppose further A combined with c to saturation (this unit I shall call Ac), should, upon the addition of b, tend to unite with it to the exclusion of c, A is then said to attract b more strongly than c, or to have a stronger elective attraction for it; lastly, let the union of Ab, upon the addition of a, be broken, let b be rejected, and a chosen in its place, it will follow that a exceeds b in attractive power, and we shall have a series a, b, c in respect of efficacy. What I here call attraction, others denominate affinity..." (Bergman 1775, cited in Howe 1978:374-

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236 In the final paragraph of Kritik der praktischen Vernunft, Kant suggested the "moral sciences" proceed according to the methods of mechanics or chemistry: "Diesen Weg nun in Behandlung der moralischen Anlagen unserer Natur gleichfalls einzuschlagen, kann uns jenes Beispiel [der Mechanik] anrätig sein, und Hoffnung zu ähnlichem guten Erfolg geben. Wir haben doch die Beispiele der moralisch-urteilenden Vernunft bei der Hand. Diese nun in ihre Elementarbegriffe zu zergliedern, in Ermangelung der Mathematik aber ein der Chemie ähnliches Verfahren, der Scheidung des Empirischen vom Rationalen, das sich in ihnen vorfinden möchte, in wiederholten Versuchen am gemeinsamen Menschenverstande vorzunehmen, kann uns beides rein, und was jedes für sich allein leisten könne, mit Gewissheit kennbar machen, und so, teils der Verirrung einer noch rohen ungeübten Beurteilung, teils ... den Genieschwüngen vorbeugen, durch welche, wie es von Adepten des Steins der Weisen zu geschehen pflegt, ohne alle methodische Nachforschung und Kenntnis der Natur, geträumte Schätze versprochen und wahre verschleudert werden." (Kant 1977:301-2)

5)[237].

In the climate of the beginning of the 20th century, with the influence of vulgar marxists' economic determinism, Weber tried to escape such a narrow way of thinking using the metaphor of elective affinities. The vulgar marxists' interpretation of social life and social evolution was based (1) on the base-superstructure model which was (2) taken in a causal way and (3) with the superstructure explained in purely economic terms. Engels protested against this interpretation [238] but his intervention hardly settled the debate. Ever since then, orthodox Marxists have enormous difficulties in handling the relations in the base-superstructure model.[239] Against this poor model, and the confusion which it caused, Weber suggested another analytical model, as, for example, in The Protestant Ethic and the Spirit of Capitalism:

> "In view of the tremendous confusion of interdependent influences between the material basis, the forms of social and political organization, and the ideas current in the time of the Reformation, we can only proceed by investigating whether and at what points certain correlations [Wahlverwandtschaften] between forms of religious belief and practical ethics can be worked out." (Weber

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237 "From chemistry and Bergman would come the basic paradigm of elective affinity; from literature and Goethe, its application to the portrayal of social relationships; from philosophy and Kant, the art of divorce of the empirical from the rational and the affinity of all things in their possibility." (Howe 1978:382)

238 See his letters to Joseph Bloch, 21.-22.9. 1890; to Conrad Schmidt, 27.10. 1890; to Franz Mehring, 14.7. 1893 and to W. Borgius, 25.1. 1894.

239 Thousands of scholars since then have been looking for the "last instance" or the "relative autonomy".

1905, transl. Parsons:91)[240].

Certainly, there have been attempts to define the marxist term of "determination" exactly in this sense of "correspondence", or "correlation".[241] Cohen too suggests something similar when he says that an existing productive force is only compatible with a small range of social relations[242], which means that a strict determination does not obtain. Weber's methodological programme is thus a comparatively modest one, in the sense that it does not establish causal or lawful connections: "When we construct a 'stage of culture', then this thought construct, analyzed into judgements, means only that the individual appearances that we thereby assemble conceptually are 'adequate' to one another, possess a certain measure of 'inner affinity' [innere Verwandtschaft]... with one another, but never that they follow from one another with any kind of lawfulness." (Weber 1905, as cited in Howe, 1978:378).

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240 Unfortunately, Parsons translated Wahlverwandtschaft as correlation instead of elective affinity. Howe's translation reads as follows: "...in view of the immense confusion of reciprocal influences between the material bases, the forms of social and political organization, and the intellectual and spiritual contents of the cultural epochs of the Reformation, one can proceed only by first of all inquiring as to whether and in what points definite elective affinities between certain forms of its religious faith and its work ethic are discernible." (Howe 1978:368) See also Schluchter (1981:142).

241 See Raymond Williams' suggestion that a determination sets only limits and does not determine ("bestimmen") in the strong sense (Williams 1977:83-9). But the problem is not just a semantic one of how to translate the German "bestimmen", since Engels already had trouble in explaining what "bestimmend in letzter Instanz" meant (see above).

242 The underdetermination of the relations by the forces of production is developed in Cohen (1978:163-5).

Recall, now, Marx's analysis of capitalism and machinery. We can view it from the standpoint of Cohen's, Luhmann's and Weber's standpoint. According to Cohen, we would get a functional relation between productive forces and social relations. According to Luhmann, there may be functional equivalents to actual solutions and we should avoid the mistake of regarding the actual as the "necessary" and inescapable solution. Piore and Sable, for example, claim that handicraft production (combined with computer technoogy) may well be a "functional"[243] alternative to industrial mass production (Piore and Sable, 1984). According to Weber, there must obtain "elective affinities" between the elements which form a unit. The question if machinery is compatible with communist society may serve as an example here. As we have seen in chapter 3, Marx was ambiguous about this problem. In the Manuscripts of 1861-3, he regarded machinery as inherently de-skilling, leading to the enslaving and crippling of human beings. In Capital, he revised his position, stressing the cooperative character of mass production and blaming only the social form, i.e. capitalism which employs machinery. From the viewpoint of present-day western societies we might add the effects of machinery on the natural environment. In the following sections I shall thus try to establish some possible relations between capitalism and machinery, postponing the question of communism to chapter 5.

4.3. Capitalism and Machinery as autopoietic systems?[244]

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243 I put functional in quotation marks, because the authors themselves do not use the term.

244 This section owes much to discussions I had with Gunther Teubner.

The starting point for my elaboration here is the curious way in which Marx links capitalism and machinery. He wants to stress that capital has found in machinery its adequate mode of production [245] which is to say that before the use of machinery the mode of production could not be called capitalist:

> Modern Industry had therefore itself to take in hand the machine, its characteristic instrument of production, and to construct machines by machines. It was not till it did this, that it build up for itself a fitting technical foundation, and stood on its own feet. (Capital 1:363).[246]

With respect to the social form, he says that only from that point on, where capital exists in its "pure" form (i.e. essentially as capital-labour relation), does it stand on its own feet and is therefore capitalist in the real sense of the word.

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245 "Bei der reelen Subsumtion... treten alle die changes ein in dem technologischen Proceß, Arbeitsproceß, die wir entwikkelt haben... Es ist hier also nicht nur das formelle Verhältniß das sich ändert, sondern der Arbeitsproceß selbst. Einerseits schafft die capitalistische Productionsweise... eine veränderte Gestalt der materiellen Production. Andrerseits bildet diese Veränderung der materiellen Gestalt die Basis für die Entwicklung des Capitalverhältnisses... theils als Folge, theils als Basis." (MEGA II.3.6.:2142, my emph.) "Mit der realen Subsumtion der Arbeit unter das Capital findet eine völlige Revolution in der Productionsweise selbst statt..." (MEGA II.3.6.:2143-4)

246 "The full development of capital, therefore, takes place - or capital has posited the mode of production corresponding to it - only when the means of labour has not only taken the economic form of fixed capital... and when fixed capital appears as a machine within the production process, opposite labour; and the entire production process appears as not subsumed under the direct skilfulness of the worker, but rather as the technological application of science." (Grundrisse:699, my emph.; cf. also MEGA II.3.6.:2059) It would be an interesting question to ask if this is also true the other way round. In other words, can we assume that machinery has found in capital its adequate social expression?

> "The capitalist system presupposes the complete separation of the labourers from all property in the means by which they can realize their labour. As soon as capitalist production is once on its own feet, it not only maintains this separation, but reproduces it on a continually extending scale." (Capital 1:668, amended translation).

This is a process which

> "transforms, on the one hand, the social means of subsistence and of production into capital, on the other, the immediate producers into wage-labourers." (Capital 1:668)

The capitalist mode of production

> "produces not merely the material products, but reproduces continually the production relations in which the former are produced, and thereby also the corresponding distribution relations." (Capital 3:879)

In both cases the "crutches" of precapitalist modes of production could be thrown away. We are thus in both cases dealing with self-referential operations: production of capital by means of capital, production of machinery by means of machinery. It seems tempting to apply autopoietic systems theory to these two processes since Marx himself conceives the material and the social as self-referential processes.[247]

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247 Sztompka (1974:177) has claimed that "Marx may be pronounced the forefather of the modern systems approach in social science." In an illuminating article, Amburgery and McQuarie try to interpret Marx's categories in a systems-theoretic way. In contrast to Cohen, who stresses the primacy of the productive forces, Amburgery and McQuarie emphasize the "reciprocal linkeages between the various subsystems of this model." (Amburgery and McQuarie 1977:100). In their view Marx's model is an open systems model, since every social form stands in relation to the natural environment from which it gets its "inputs". In autopoietic systems theory

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Autopoietic theory has been developed in biology (Maturana 1980; Varela 1980) and in social theory (for example, Luhmann 1984, Hejl 1982; Willke 198.; Teubner 1988).[248] This "emerging paradigm" takes as its point of departure the concepts of "self-reference", basic circularity and operative closure of social systems. However, as has been emphasized by several proponents (Teubner 1987,1989; Roth 1987; Bühl 1987; Zolo 1988) one has to be careful not to mix up the concepts of self-referentiality, self-reproduction, and autopoiesis.

Autopoietic theory defines system and environment in a different way than "General Systems Theory"; it combines systems theoretical elements with evolutionary theory and post-ontological epistemology. In some versions, like Luhmann's, it tries to overcome basic theoretical difficulties of older sociological approaches, like Parsons's structural-functionalism or General Systems Theory.

How is an autopoietic system defined? Stichweh, following Luhmann, gives four criteria which must be fulfilled to call a social system autopoietic:

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the systems are conceived as closed systems; the natural environment has the status of a material continuum. In a way, there arises again the problem of variable discretion i.e. the problem of defining variables independently of each other. Autopoietic theory is more precise in defining system-boundaries than the open-systems approach. Since I do not think that we should use the concepts of productive forces and relations of production as units of analysis, I propose to take the economy, politics and science as closed systems.

248 For a critique which is not completely hostile to the concept of autopoiesis as such, but doubts the validity of using it in broad analogy to biology as a new "super-paradigm", see Bühl (1987).

1. operational closure: operations of the system relate only to operations of the same system;
2. definition of its own elements: the systemic process defines what will function as its elements;
3. production of its own elements: an autopoietic system is a network of processes which produce elements for this system;
4. Self-definition of the system-boundary (cf. Stichweh 1987:448-9).

Someone might propose to apply criteria 1-3 to technology and say that technology is operationally closed and has clearly defined elements. He would probably describe technology as a system of instrumental artifacts which produces instrumental artifacts.[249] Taking this assumption for granted for the sake of the argument, we could therefore say that technology is operationally closed. Turning to the elements of the system, we might say that it does not matter of which substances the elements of an autopoietic system consist (they may be books, factory buildings, banks or persons), because "elements" of the system are not things or persons, but operations. However, as shall become clear in a moment, such a proposition fails on the general ground that technology cannot be conceived as a social system. According to Luhmann, a social system "consists of meaningful communications - only of communications, and of all communications. It forms its elementary units from the synthesis of information, communication,

249 It would be production of technology by means of technology (to allude to Sraffa's Production of Commodities by Means of Commodities). Taken in the above sense, technology would be a special case of commodity. Now it would not be difficult to show how value-production can be seen as a circular process. But can we also apply this circularity to technology? Marx himself gave us a few hints to conceive technology in that way i.e. as basic circularity, see, for example, Capital 1:363; Grundrisse:699.

comprehension..." (Luhmann 1988a:18). Again, technology could be conceived as a specialised social communication which can be defined apart from political, religious, economic, and scientific communications. Technology could even be conceived of as a self-referential and self-reproductive process: whenever engineers are constructing a new technology, they are likely to take machines and textbooks of colleagues as models (see Rammert 1988). However, technology cannot be conceived as an autonomous social spehere, since it is no meaning-based system. It would be absurd to see the essential elements in a thus conceived technological social system as consisting of communicative events. What gives technology its specific role in social life is, on the contrary, that its basic elements are material in character.[250]

In addition to the above definition of a social system, Luhmann calls a social system an autopoietic system in so far it is

> "a recursively closed system, which can neither derive its operations from its environment nor pass them on to that environment. It cannot communicate with the environment but it can and must necessarily communicate about the environment... This is a very clear, very unequivocal state of affairs, which does not pose any fundamental difficulties in the concept of unity or in the demarcation of the system from the environment... [The system] does not, for example, consist of physical events nor of isolated individual behaviour..." (Luhmann 1988a:18-9).

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250 A further clarification might be in order here. Cohen (1978) holds that the antonym of "material" is not "ideal" but "social". In my conception, this opposition is less rigid; I agree with Cohen that technology is to be distinguished from social relations but I do not agree that it is completely asocial in nature.

According to Luhmann's position, "[a]n autopoietic system ... constitutes the elements of which it consists through the elements of which it consists." (Luhmann 1988a:14). Elements of a social system are events or communications. Events "have no duration in which they can change, but disappear immediately on their emergence... Since the social system ... consists of nothing but communications, it belongs to this type of system that consists of events." (Luhmann 1988b:341-2) From this account it is difficult, if not impossible, to conceive technology as a social system.[251] Take first the aspect of events. Since technology produces durable artifacts, it hardly falls under the category of an "event". Consider, next, the aspect of communication. Technology may be conceived of in communicative terms as well. This is the case when, for example, engineers discuss the design of a new machine, or when politicians confer on the problem of dangerous technologies. But the "essence" of technology can hardly be grasped with the notion of communication alone. Technology typically produces "a machine, a drug, or a process of some kind" (Price 1982:170).

Luhmann additionally brings to bear a further criterion: every functional sub-system of society has its own "binary code" which organises its operations. He defines money as the "code" of the

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251 From Luhmann's quote it also becomes clear that Marx's thought and autopoietic theory are located on two different "ontological" levels: the former assumes that societies are able to have a direct contact with their environment, the latter denies exactly this and insists on the purely communicative dimension of society. For Marx, the possibility that society has a direct contact with nature was at the very heart of his theory. As we saw, he regarded the conscious transformation of nature as the precondition for history. For autopoietic theory, on the other hand, an environment "out there" does not exist; what exists are only system-internal constructions of reality. I return to this problem below.

economy, power the code of the political system, truth the code of the scientific system etc. The point of Luhmann's argument is that the autonomy of the various social systems consists in their coding: it is the economy which decides what counts as payment and what not; it is the political system which decides what counts as power and what not; it is the scientific community which decides what counts as scientific knowledge and what not. It follows as a corollary that politics cannot solve the problems of science, the economy cannot solve problems of the political system, science cannot solve the problems of economy etc.

In this sense a technological system is neither a social nor an autopoietic system. It is the realm in which mankind organizes its Stoffwechsel with nature. This is a process which proceeds partly by means of communication, partly by means of material transformation of the environment. From my definition and the discussion in 3.3. it follows that the material dimension is crucial for the concept of technology. Luhmann's theory also draws attention to this material element as "eternal presupposition" for social systems:

> "All systems form in a presupposed materiality continuum, which Maturana calls medium. For example, they presuppose a structure of matter rooted in atoms, just as the formation of atoms obviously presupposes energy capable of being bound. In the formation of systems, then, there is never any kind of recreation of the world in each individual case. This materiality continuum which has in each case to be presupposed takes no heed of the system boundaries of the differentiating system; it is both inside and outside the system. It nevertheless limits the possibilities of system formation, since only such systems are possible that are compatible with the materiality continuum. The emergence of social systems based on meaning processing presupposes the existence of a multiplicity of such materiality continua and is thus rather improbable." (Luhmann 1988b:338).

Social systems rest on this material continuum but operate on the basis of social meaning. In so doing, they are constructing their own social reality.

So far the notion of material continuum is in accordance with Luhmann's use. However, I think we can make use of it in another respect as well. It fulfills the function of keeping together the different social systems "from below". It makes plausible that politics, economy and science not only get in contact occasionally or punctually but that they are coupled on the basis of this material continuum. This provides the "material basis" for the linkeage of the social systems which have an influence on technology. Assuming that the three social systems are relevant for the development of technology (science, politics, economy), from a cross-tabulation we get three relevant combinations. The potential financial reward of a technological invention links technology immediately to the economic system (E-t-[S]), perhaps without giving much importance to the scientific system. Science is the environment for the economy i.e. inventions depart from an available given standard of scietific knowledge. If for political reasons research is directed towards certain goals, it is the political system which gives rise to that research. The financing involves the economic system too (P-S-E-t). The political system may also enhance technological development in a direct way by subsidizing innovative firms (P-E-t).

At this point a basic objection could be made. As I discussed Marx's model of Stoffwechsel, it was clear that society (by virtue of its "Arbeitsprozeß") had the possibility of transforming the environment in a physical way. It is precisely this possibility that is denied by Luhmann. It is impossible for society to derive operations from its environment and to pass operations on to that environment. How can we, then, reconcile the proposed systems

approach with Marx's analysis of technology? Are the two theories mutually-exclusive since they presuppose different ontologies?

I shall not doubt that the theories are far apart with regard to ontological considerations. However, they are by no means incompatible. The solution is quite easy: Luhmann's theory also acknowledges a "materiality continuum" which is presupposed to systemic operations and which is inside and outside social systems (see also 4.3.3.).

In Marx, the labour process is a goal-oriented transformation of nature which takes place with tools (or processes) and is "zweckrational" i.e. determined by means-ends relationships. From this goal-orientation it follows that technology stands in a close relationship to rational human action or to a systemic rationality: the goals are in most cases clearly defined by technical imperatives: produce product x!, solve problem y!, adjust Z! whereas autopoietic systems do not have a final goal, end, or 'telos'. The product and goal of their working are they themselves. Marx on the level of the valorisation process employed a method which can be seen as showing all traits of "basic circularity" and self-reference, even of autopoiesis.[252] The capitalist economy is an autopoietic system par excellence (see also Breuer 1987). But, as we have seen, it is not possible to extend this analogy to the process of use-value production as such, to man's transformation of nature, in short, to technology.

These considerations suggest that the possibilities of influencing technology are not so small. It seems that pessimistic analyses which have it that technology has slipped out of control of

252 See his definition of capital as essentially referring to itself, as "automatisches Subjekt" (Das Kapital 1:169).

human action (Ellul 1964; see also Winner 1977) tell only half the truth: it is true, indeed, that technology is evolving according to its own Sachgesetzlichkeit ("technical imperatives"), moves in the way of "trajectories", and cannot be determined by individual action. Furthermore, it is true that attempts to change existing technologies in some normative direction must fit three different logics or pass three different "filters". This narrows down the range of feasible possibilities. But it is not true that technology as such develops according to its own logic (inner code), or even moves away from the human world. A pessimistic argument would have to show that all technologies have merged together into one technological trajectory from which no escape is possible.[253] But this argument seems to be absurd: for example, there is nothing inherently technological which would prescribe the exclusive use of nuclear energy in industrially-developed countries.

In a particularly useful essay, Hughes also addresses the problem of identifying a technological system when he says that "[t]echnological systems solve problems or fulfil goals using whatever means are available and appropriate; the problems have to do mostly with re-ordering the physical world in ways considered useful or desirable..." (Hughes 1987:53) However, his approach is not informed by autopoietic theory. Rather, so its seems, he remains with a model which conceives systems as open, input-using and output-producing. But how do we distinguish a technological system then from any other system? Or are all social systems varieties of one, all-embracing technological system? In this case we could conceive of the technological system as a subsystem of every social system: politics, law, economy and art use

253 See Adorno and Horkheimer (1981) as an illustration of such pessimism.

technologies.[254] Hughes is also aware of the difficulty when endorsing the wide definition of technology. He thus tries to make the following qualification to the definition of technology: "It is problem solving usually concerned with the reordering of the material world to make it more productive of goods and services." (Hughes 1987:53, my emphasis). But the criterion of productivity is basically an economic one, which is to say that technology itself cannot measure the "productivity" of itself.[255] But a definition which stresses the urge for novelty won't do either: many other systems are concerned in the same way about that. Hughes' solution is thus to resort to a sort of action theory. It sounds ironic, but to make his system approach work, he needs a systems builder i.e. a person who forges the heterogenous elements together and takes care that new technology will be more productive.

My suggestion, then, is to define technology because of its heterogenous character as "allopoietic" (cf. Maturana 1982:159). It is essentially instrumental, a pool of skills and knowledge which is linked to all other systems: science, economy, and politics.[256]

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254 See Weber (1972:32).

255 For another attempt see Dosi, supra. Engineers who work in the field of machines and power transformation usually use "Leistungsgrad" (performance) as an indicator for the efficiency of their products, but this physical criterion is quite different from efficiency in the economic or social sense.

256 The first relation is emphasized by Price, the first and the second by Rosenberg, the second and the third by Piore and Sabel. For the influence of politics on technological development see also Dosi (1984), Burke (1975) and Klein (1977).

Having rejected the notion of an "autonomous" technology, I now ask: How shall we conceive of the coevolution of technology and society? Is technology at any point in time socially determined and hence subjected to human design? Instead of determining life, is it not itself completely determined by social arrangements? I deal with this question in two steps.

(1) As far as the question juxtaposes social and technological determinism, it is paralleled by a similar ambivalence in Marx. As I suggested above, Marx believed in both technological determinism and social determinism because of a twofold theoretical interest. Its first element is historical: to find out which variable 'explains most'; the second element is critical: to estimate the technological and social possibilities and requirements for a communist society. From this follows Marx's reductionism and his determinism of one sort or another. There is nothing wrong with reductionism and determinism if it is supported by certain theoretical assumptions and empirical evidence. My suspicion is, however, that Marx was led astray by this approach. He wavered between a social and a technological determinism depending on his prevailing theoretical interest. In a very rough way,[257] we can say that he was a technological determinist when he tried to explain historical development ('backwards'-oriented), but became a social determinist when he tried to evaluate the possibilities for a communist society ('forwards'- oriented). [258]

Recent studies in the history and sociology of technology are strongly opposed to technological determinism (Pinch and Bijker

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257 For the necessary qualifications, see 3.4.

258 As we saw in 3.5. and 3.6., the two approaches can be found in a nearly ideal-typical way in the Manuscripts 1861-63 and in Capital.

1987; Hughes 1987; Law 1987; MacKenzie 1987) and argue for a strong social determinism. Pinch and Bijker try to apply the "strong programme" (developed in the sociology of science) to technology. The label they adopt therefore is "Social construction of technology" (SCOT). The starting point for their approach is the Kuhnian notion of scientific paradigm, especially as further developed by Mulkay and others. Whereas Kuhn restricted his analysis to the natural sciences, several attempts have been made to extend it to the social sciences. Pinch and Bijker now try to apply it to technology, thus claiming that technology, just like natural and social sciences, is a social construction which gets stabilized during a process of "closure" i.e. technologists come to agree on a specific technology as the solution to a specific problem. There is nothing "inherently" superior in a technology which becomes dominant over competing technologies; it is simply a matter of convention. From this it follows that a history of technology has to dispense with the idea that dominant technologies are the "better" technologies in comparison to other technologies. The point is to treat successful and unsuccessful technologies in the same way ("symmetry of explanation") and to show how contingent factors led to a decision which selected this or that technology. In my view this approach is a good starting point for any sociological analysis of technology. However, there are two comments I want to make. The first is that the notion of "social shaping" is too vague. As I have shown above, the "social" must be further decomposed into social subsystems (politics, economics, and science) in order to trace the inner dynamics of technology. From this it follows that it is not sufficient that "technological closure" takes place; the technology which is successful in the "middle run" has to pass through economic and political filters as

well.[259] The second point is that Pinch and Bijker try to employ their argument as an argument against an evolutionary view of technology. They assume that once they can show that a process of closure takes place in the technological field, this is evidence against an evolutionary view of technology. But this assumption is completely mistaken; the contrary follows from their argument. To disprove an evolutionary view it is not sufficient to show that intentional human actions and choices are at work. As the example of the deck of cards (cf. Weick 1979) can show, an attribution of the label "evolution" to any development of an entity over time depends in the first place on the criteria of order which an observer wants to apply (see also 3.3.1.).

Thomas P. Hughes admits that technological systems "are both socially constructed and society shaping..." (Hughes 1987:51). Viewing technology as system, he comes close to attributing an autonomous development to it. However, Hughes refuses to subscribe to such a notion. He coins the term of "momentum" for the phenomena that technological systems consolidate and grow. As he explicitly points out, "[m]omentum... remains a more useful concept than autonomy. Momentum does not contradict the doctrine of social construction of technology, and it does not support the erroneous belief in technological determinism. The metaphor encompasses both structural facts and contingent events." (Hughes 1987:80). I think this formulation makes the point very well: what is needed is a theory which is capable of combining structural and contingent events. Hughes, however, does not offer much of such a theory. Unfortunately, he limits himself to historical illustration and very weak theoretical generalisations. On the one hand, he doubts the autonomy of technology (Hughes 1987:79), on the other he concedes

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259 Consider the cases of nuclear energy and genetic engineering.

that "[l]arge systems with high momentum tend to exert a soft determinism on other systems, groups, and individuals in society." (Hughes 1987:54-5, my emphasis) But how can technology exert a determining force if it is not autonomous? This question leads to the second step of my discussion.

(2) As far as the objection juxtaposes autonomous and heteronomous systems the following can be said. As theoretical and empirical considerations show, the 'malleability' of technology has its limits. It seems that it is not possible to impress a specific shape on existing technology at any time in any direction. Such attempts are likely to fail in one of three senses: these attempts may be dysfunctional, irrelevant or detrimental to the acting system itself. [260] As Piore and Sabel (1984) maintain, there exist specific 'branching points' in the development of technology which make 'human choice' possible. But apart from the strong notion of social construction of technology, we should consider another possibility which goes beyond the question of "determination". In this conception technology is conceived of having some 'eigendynamics' (in the sense that technical properties inhibit or enhance certain technological developments), but is at the same time shaped by social factors. Let me thus return again, this time in more detail, to evolutionary theory.

4.3.1. Evolution and Darwinian systems

The systems-approach which I discussed in the last section and the evolutionary approach which I shall examine in this section, have

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260 Cf. Teubner's 'regulatory trilemma'; Teubner (1987).

a common reference point in functionalism. As van den Berghe put it,

> functionalism and the dialectic share an evolutionary notion of social change. For both Hegel and Marx the dialectic process is an ascensional spiral towards progress. The functionalist concept of differentiation postulates an evolutionary growth in structural complexity and functional specificity analogous to biological evolution. Admittedly, these two evolutionary views are different, and each presents serious difficulties. We are all aware of the pitfalls of organicism, the teleological implications of 'progress', and the untenability of assuming that evolution is unilinear or has an endpoint... Nevertheless, the convergence of the two theories on some form of evolutionism suggests that the concept of social evolution (in the minimal sense of change in discernable directions) may be inescapable..." (van den Berghe 1963:703)

Kolakowski stressed that Marx endorsed an evolutionist view of history (progress!) which he adopted from Hegel : "Hegel's historicism had played an important part in the origin of Marxism, by providing a basis for the evolutionist view of history." (Kolakowski 1978:250). But Marx also endorsed Darwin's approach, praising his anti-teleological implications.

> "Darwin's work is most important and suits my purpose in that it provides a basis in natural science for the historical class struggle... Despite all shortcomings, it is here that for the first time, 'teleology' in natural science is not only dealt a mortal blow but its rational meaning is empirically explained." (Marx, letter to Lassalle from 16.1.1861)[261] .

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261 This is not to say that Marx subsequently broke with teleology having read Darwin. His theory of history in fact bears a strong teleological influence; but perhaps he saw his theory as explaining the "rational meaning" of such an apparent teleology. Without any doubt, his theory was intended to ...

Since Marx's analysis explicitly attempts an evolutionary explanation of productive forces and mode of production, we might look a little bit closer at Darwinian systems. Eigen and Schuster (1977; 1978a; 1978b) have emphasized the following properties of Darwinian Systems which they regard as their "necessary prerequisites":

> "The essential requirement for a system to be self-selective is that it has to stabilize certain structures at the expense of others... The criteria for evaluation must involve some feedback property, which ensures the identity of value and dynamic stability. An advantageous mutant, once produced as a consequence of some fluctuation, must be able to amplify itself in the presence of a large excess of less advantageous competitors." (Eigen and Schuster 1977:547).

The "advantageous mutant" in our case is, of course, the machine. But Marx's theory contains also an evolutionary scheme for the modes of production. The "advantageous mutant" in this case is capitalist commodity production. We can conceive the evolution of technology (machinery) and mode of production (commodity production) a) in isolation from each other and b) in co-evolution with each other.[262]

...

provide the scientific explanation for the advent of communist society.

262 According to Schumpeter's striking phrase, you may "add as many mail-coaches as you please, you will never get a railway thereby." (Schumpeter 1934:54) But equally important is to stress that the new emerges as a result of recombinations of the already existing; as Loh stressed: "Das Neue in einer Entwicklung kommt zum Bisherigen nicht einfach hinzu, sondern das Neue konstelliert sich durch Formenentwicklung aus dem bis dahin Entwickelten. Entwicklung ist ein Kombinationsprozeß." (Loh 1975:261) This is Marx's evolutionary approach which Marx himself usually labelled (somewhat misleadingly) "materialism".

a) This case would apply to machines which emerged long before capitalism. It is the case of specialization and differentiation that Marx refers to. They were the precondition for the rise of machinery. [263] Capital also existed before capitalism, above all in the form of money capital. However, far more interesting for my study is b). Here we can make use of the concept of "functional linkages". One of Marx's implicit theoretical tasks was to provide an explanation for the fact that out of a variety of technologies and modes of production the capitalist mode and machinery, combined together, became the successful ones and drove out all others (or pushed them into 'niches').[264] Moreover, they survived by reinforcing one another. The mechanism can be described as follows:

> "Functional integration of an ensemble consisting of several self-replicative units requires the introduction of catalytic links among all partners. These linkages, superimposed on the individual replication cycles of the subunits, must form a closed loop, in

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263 The two model-machines which the 16th century inherited from antiquity were the clock and the mill. Cf. Marx's letter to Engels of 28.1.1863. Note that both machines are not based on a deskilling of the handicraft worker; this aspect furnishes a theoretical perspective which conceives machinery not as primarily something which expropriates the worker from his skills but as something solving Stoffwechsel problems in a unique way. In other words: in cases where no skills are expropriated, machinery could be the basis for a communist society. However, it would also have to conform to ecological standards.

264 Ballmer and von Weizsäcker criticised in Eigen and Schusters' model of the hypercycle that it does not allow for "niches": "Eigen läßt den neben Mutation und Selektion gleichgewichtigen Evolutionsfaktor der Isolation unberücksichtigt." (Ballmer and von Weizsäcker, 1974:248) This neglection might inhibit the very emergence of evolution: "Die Eigensche Theorie baut gegen die Fortführung der Evolution über die Hyperzyklenstufe hinaus das entscheidende Hemmnis selbst auf: Die Ausrottungsstrategie des erfolgreichsten Hyperzyklus gegen alle anderen, wie sie in Eigens quasiphysikalischem Fitness-Kriterium angelegt ist." (ibidem).

> order to stabilize the ensemble via mutual control of all population variables. Independent competitors, which under certain spatial conditions and for limited time spans may coexist in 'niches', as well as catalytic chains or branched networks are devoid of self-organizing properties, typical of hypercycles. Mere coexistence is not sufficient to yield coherent growth and evolution of all partners of an ensemble." (Eigen and Schuster 1978a:40-1).

Recall here Marx's description of capitalism where machines are built by machines, capital produced by capital and, as a precondition, labourers are separated from all means of production. Before the advent of capitalism, all these elements (also the model-machine mill) had existed in niches. As we shall see, Marx is never suffciently clear on whether technology is a "self-replicative unit" or a "functional linkage".[265]

Eigen and Schuster list several properties of the so-called hypercycle, from which the seventh is of special interest here: "Selection of a hypercycle is a 'once-for-ever' decision. In any common Darwinian system mutants offering a selective advantage can easily grow up and become established. Their growth properties are independent of the population size... a hypercycle, once established, can not easily be replaced by any newcomer, since new species always emerge as one copy (or a few)." (Eigen and Schuster 1978a:41). With these methodological tools, we may read the following passages from the Manuscripts and gain new insight into the problems with which Marx was confronted in his enterprise.

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265 See von Neumann (1966) for an exposition of how we may conceive of machines capable of self-replication.

In the following passage, Marx stresses the gradual development of modes of production and technology using an analogy to geology:

> "Wie man bei der Reihenfolge der verschiedenen geologischen Formationen nicht an plötzliche, scharf getrennte Perioden glauben muß, so nicht bei der Bildung der verschiedenen ökonomischen Gesellschaftsformationen. Im Schoß des Handwerks entwickeln sich die Anfänge der Manufactur und findet sich stellenweise... schon Anwendung von Maschinerie..." (MEGA II.3.6.: 1972).

Note that Marx, while speaking of "economic modes of production", gives examples of technologies in order to distinguish them: artisan production, manufacture and machines. Evolutionary theory also stresses the gradual development, the emerging of one form out of another: "Evolution is conservative and therefore appears to be an almost continuous process, apart from occasional drastic changes. Selection is in fact based on instabilities brought about by the appearance of advantageous mutants that cause formerly stable distribution to break down. The descendants, however, are usually so closely related to their immediate ancestors that changes emerge very gradually." (Eigen und Schuster 1978b:367).

> "Das allgemeine Gesetz aber, das durchgeht, daß die materielle Möglichkeit der späteren Form in der früheren geschaffen wird, sowohl die technologischen Bedingungen, als die ihnen entsprechende ökonomische Struktur des Ateliers." (MEGA II.3.6.:1973)[266]

> "Es ist hier vor allem zu bemerken, daß es sich hier um keine genaue technologische

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266 Cf. also Grundrisse: "It must be kept in mind that the new forces of production and relations of production do not develop out of nothing, nor drop from the sky, nor from the womb of the self-positing Idea; but from within and in antithesis to the existing development of production and the inherited, traditional relations of property." (Grundrisse:278)

> Scheidung handelt, sondern um solche Revolution in den angewandten Arbeitsmitteln, die die Productionsweise und daher die Productionsverhältnisse umgestaltet; also hier speziell die capitalistische Productionsweise characterisirt." (MEGA II.3.6.:1915).
>
> Mit der einmal erreichten Revolution in den Produktivkräften - die sich technologisch zeigt - tritt auch Revolution in den Produktionsverhältnissen ein." (MEGA II.3.6.:1973, my emphasis).

It may be said that these quotes strongly support a technological-determinist view of history i.e. the emergence of the machine caused the change in the relations of production: after the revolution in productive forces comes a revolution in the relations of production. But there need not be a causal relation. Marx only says that with technological revolution a social revolution also occurs. Technical and social revolution are thus parallel processes, with no causal connections involved. This interpretation is further supported by Marx's affirmation that not only present technology but also the present mode of production must have forerunners in the previous evolutionary stage: "Das allgemeine Gesetz aber, das durchgeht, daß die materielle Möglichkeit der späteren Form in der früheren geschaffen wird, sowohl die technologischen Bedingungen, als die ihnen entsprechende ökonomische Struktur des Ateliers." (MEGA II.3.6.: 1973, my emphasis).[267] This allows two possibilities of conceiving the "social" and the "technical": a causal and a functional model of historical change. We may interpret the following passage in both ways:

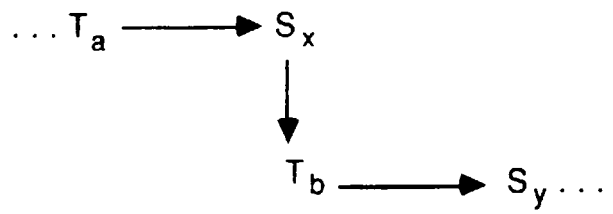
> "Die durch Theilung der Arbeit in der auf sie begründeten Manufactur gegebne Differenzierung, Specialisirung und Vereinfachung der Arbeitsinstrumente - ihre exclusive adaption to very simple operations - ist eine der

267 See also Grundrisse:278, previous fn.

> technologischen, materiellen Voraussetzungen für die Entwicklung der Maschinerie als eines die Productionsweise und Productionsverhältnisse revolutionirenden Elements." (MEGA II. 3.6.:1914, my emphasis).

Consider first the causal interpretation. According to this the division of labour leads to ("causes") differentiation and specialization of the work instruments which constitutes the material condition for the development of machinery. Machinery, in turn, is one of the elements which leads to a revolution of the mode and the relations of production. If we leave aside the division of labour for a moment, we get the following sequence:

Fig. 4.1



Technology T_a leads to social revolution and eventually to social form S_x. Within this social form S_x a new technology T_b arises which brings about social form S_y. Note that we have both a technological and a social determinism here: T_a ----> S_x stands for the technological, S_x ---> T_b stands for the social determinism.[268] There is a causal effect of technology on the social form before a revolution and a causal effect of the social form on technology

268 This model also fits Cohen's claim that productive forces exert primacy over the relations of production but the latter stabilize and enhance the former. In case it loses this propitious feature, it is eventually replaced by a new social form.

after a revolution. The canonical source for a technological determinism is the 1859 Preface; support for social determinism are found in the following passages from Capital 1:

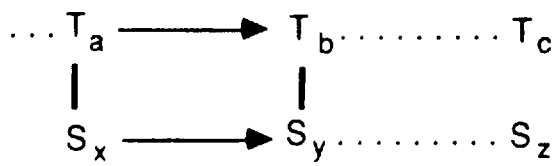
> "At a given stage in its development, the narrow technical basis on which manufacture rested, came into conflict with requirements of production that were created by manufacture itself." (Capital 1:347) "Manufacture produced the machinery, by means of which Modern Industry abolished handicraft and manufacturing systems in those spheres of prouction that it first seized upon. The factory system was therefore raised, in the natural course of things, on an inadequate foundation. When the system attained to a certain degree of development, it had to root up this ready-made foundation, which in the meantime had been elaborated on the old lines, and to build up for itself a basis that should correspond to its methods of production." (Capital 1:361).

In both cases the "requirements" or the "methods of production" are the driving force which cause a change in technology. This is clear illustration that the growth of the productive forces has to be explained in a social way. Cf. also:

> "Unmittelbar wird die Maschinenarbeit als revolutionierendes Element ins Leben gerufen durch den Überschuß des Bedürfnisses über die Möglichkeit, ihn mit den alten Produktionsmitteln zu befriedigen..." (MEGA II.3.6.:1973).

Consider now the second possibility.

Fig. 4.2



In the language of Eigen and Schuster this is a case of "functional integration". According to Eigen and Schuster, such a functional integration requires 'catalytic links' between the self-replicative units. These linkages must form a closed loop in order to stabilize the ensemble (see Eigen und Schuster 1978a:40-1). Similarly, Marx wants to establish a kind of "elective affinity" or "Wahlverwandtschaft" between machinery and capitalism. This elective affinity has the following traits. Capital as "processing value" does not know any limits. Likewise, machinery does not depend on craft skills of workers nor on an increased number of working population in order to produce more commodities: the sole limits are physical (raw materials), and technical in character. As a result, a worker who is employed by capitalist machinery becomes dispossessed in two ways: in the technological realm, he gets dispossessed of his skill, in the economic realm, of the product of his labour.[269] Note that in the case of a functional integration we have a co-evolution of social forms and technologies. Cohen said that "slavery rules out computer technology, but also computer technology rules out slavery." (Cohen 1978:153). Apart from this extreme example I shall leave open the question for the moment if capitalism with, say, craft technology, as dominant technology, is equally impossible (see chapter 5).

4.3.2. A machino-capitalist hypercycle

Using the definition of Eigen and Schuster as an heuristic device,

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269 I leave aside here if this expropriation is "just" or "unjust" - see the contributions of Wood, Brenkert, Cohen, Elster, Lukes and others with respect to the economic aspect.

I shall now try to define the "self-replicative units", the "catalytic links" and the "closed loop". In a first tentative approach, the "self-replicative units" might be listed as follows:

A capital
B labour power
C machines
D raw materials

In Marx's view, then, there are essentially two hypercycles which stabilize each other: productive forces, relations of production and the superstructure. Elements A-D all existed before capitalism; the 'capitalist hypercycle', however, is structured by the re- composition of all elements.[270] A-D are commodities which can be bought on the market; they fuse together in the production process where A-B constitutes a social relation, B-C a technical relation. B-D forms the elements of A (value) under the aspect of use-value.[271] But if Marx links up machinery and capitalism in such a definite way, it is impossible to speak of "Maschinerie an sich", independent of (bad) capitalist use: machinery is capitalistic, capitalism is machinery. Consequently, the historical perspective must change: a post-capitalist society must also be a post-machinery society. From the Poverty of Philosophy onwards,

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270 In the Grundrisse Marx emphasises that the separation of these elements was the outcome of a long historical process of dissolution of old forms of production. "Nicht so, dass Kapital die objektiven Bedingungen der Arbeit schafft." (Grundrisse, Berlin:406) Capital is the product of an evolutionary process, as are the instruments of work. "Eigen ist dem Kapital nichts als die Vereiningung der Maßen von Händen und Instrumenten, die es vorfindet. Es agglomeriert sie unter seiner Botmäßigkeit." (id.,407)

271 Marx additionally emphasizes that A and C dominate B; since "domination" has no place in Darwinian systems, I shall leave this aside here.

where he says "The handmill gives you the feudal lord"[272] Marx has a curious theoretical scheme in mind. It consists of the law-like connection of forces of production, mode of production, and relations of production. The most significant and famous expression of this is to be found in the 1859 Preface and is commonly called "historical materialism". My claim is that Marx attributes to each of these analytical units (forces, modes and relations of production) an elementary form.[273] In the case of productive forces it is (i) artisan-, (ii) manufacture-, and (iii) machine-production. In the case of mode of production it is use-value and commodity production. ("Die Waare ist die elementare

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272 "Social relations are closely bound up with productive forces. In acquiring new productive forces men change their mode of production; and in changing their mode of production, in changing their way of earning their living, they change all their social relations. The hand-mill gives you society with the feudal lord; the steam-mill, society with the industrial capitalist." (CW 6:166) The example of the handmill may be historically untenable (see Elster 1985), but here I want to emphasize that it was Marx's aim to find such correspondances.

273 Maybe we are now living in a post-machinery age which is characterized by electronic and cybernetic systems. Accordingly, we should expect a social form which corresponds to it. Much has been talked about "post-industrial" society and its charactersitics. In my view, however, the central difference of contemporary modern societies is not their industrial or post-industrial character but the difference between stratified class societies and functionally differentiated societies. In Marx's model a class division occurs also on the technological level because the great majority of the working class is an "appendage" to the machine. If we apply his model to present western societies, we would expect a new technology which is different in this respect. If machines were run by workers who are not reduced to appendages, we could speak of a new, liberating technology. See Kern and Schumann (1984) for some empirical examples.

Form des bürgerlichen Reichtums").[274] In his evolutionary model we get the sequence (j) use-value, (jj) exchange-value (commodity) and again (j') use-value production.[275] On the level of relations of production, we have slavery, feudalism, capitalism and communism. (j) corresponds to antiquity, (jj) to capitalism and (j') to communism.[276] The Middle Ages already partly produced commodities. Antiquity and communism have a social character of

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274 The crucial point around which Political Economy revolved, and which only Marx solved, was his discovery that in capitalism the product (i.e. the commodity) reflects the double character of labour which is embodied in it. In other words: the commodity unites use-value and exchange-value just as labour unites use-value-oriented concrete labour and exchange-value-oriented, surplus-producing abstract labour. Marx explicitly credited himself with this discovery (see his letter to Engels of 8.1.1868).

275 As in ancient Greece, the middle ages (i.e. its artisans) were producing essentially use-value not primarily exchange-value. This is the valuable point for Marx. But he cannot simply return to the middle ages or to antiquity since he wants to establish a use-value-orientated production on the basis of capitalist productivity (but without domination of exchange-value). The high level of productivity is the valuable point in the case of capitalism. Marx's vision of communism thus seems to assume that all good things go togehter - cf. also Elster (1985) and Lukes (1985).

276 Note that there corresponds an ethical evolutionary scheme, (Grundrisse:158) and German Ideology (CW 5:78-9), where Marx says that individuals were freer before the advent of capitalism. Habermas seems to be more optimistic as regards the evolutionary potential of the "ethical realm": "Whereas Marx localized the learning process important for evolution in the dimension of objective thought - of technical and organizational knowledge, of instrumental and strategic action, in short, of productive forces - there are good reasons meanwhile for assuming that learning processes also take place in the dimension of moral insight, practical knowledge... learning processes that are deposited in more mature forms of social integration, in new productive relations, and that in turn first make possible the introduction of new productive forces." (Habermas 1979:97-9).

production. The first is regulated by blind rules, the second by a conscious plan (and the application of science). In feudalism and, above all, in capitalism, the market co-ordinates the many independent private producers.[277] If we represent these three evolutionary strands graphically, we can detect an empty field:[278]

277 It has been claimed that there exist basically two forms of socialisation: markets and hierarchies (see Williamson 1975). Another position holds that there are three forms: market, organisation, and solidarity (see Polanyi 1944). As we shall see, it can be claimed that communism would, or should, be marketal, hierarchical or solidaric - or a mixture of them.

278 I do not further distinguish between different forms of ancient societies, such as slavery, and asiatic mode of production. See Elster (1985).

Figure 4.3

Mode of production	Antiquity	Feudalism	Capitalism	Communism
Main technology	tools	tools, manufacture	manufacture, machine	???
Form of product	use-value	use-value/ exchange-value	exchange-value	use-value
Purpose of production	production for needs	production for needs	production for surplus	production for needs
Form of socialisation	social production, regulated by blind rules	political regulation; guilds and estates, partly markets	independent producers, market regulation	social production regulated by conscious plan

A return to use-value production in communist society takes place on a higher and broader level than the Ancient one - on a higher level because mankind has more developed needs, and more capacities to fulfil them, on a broader level because the development of productive forces is enjoyed not only by a polis but by the whole of mankind.[279]

4.3.3. Structural coupling

279 I have strictly remained within the framework provided by Marx and therefore do not discuss the (questionable) heuristic value of an approach which emphasizes the character of tools for distinguishing historical epochs, see Welskopf (1974).

The elements in the model outlined above of a machino-capitalist hypercycle are partly material-physical, partly social. Only capital is a social relation, as Marx never tires of reminding us.[280] As already indicated, technology cannot be conceived of as a social system.

It might be useful to approach the problem from another viewpoint; this time the focus is on the interplay or "structural coupling" of social systems in their environment.[281] Recall the passage from Max Scheler cited in 3.3. (with my addendum regarding politics) where the drive towards domination of nature was conceived as the outcome of the following interactons: the scientist wants to construct all possible machines; the engineer wants to construct all workable machines; the entrepreneur wants to construct all profitable machines; the politician wants to construct all machines which enhance legitimation. If we transform this model from the level of interaction between individuals to the systemic level, we see the interaction of three different social systems: economy, politics and science.

Technology is an emergent phenomenon which springs from the interplay of these social systems. Because of the durability of

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280 According to him, it would be completely fallacious to conceive capital exclusively in a definite, palpable form such as money-capital, machinery, buildings etc.

281 See Maturana: "Die Geschichte der strukturellen Kopplung eines Organismus und seines Nervensystems an ein Medium ist daher eine Geschichte von Interaktionen, in deren Verlauf eine Struktur durch operationale Relationen moduliert wird, die einem Beobachter als Verhalten erscheinen, die jedoch ausschließlich strukturell bedingt und realisiert sind... (1982:21). Luhmann's theory also offers the possibility of a "structural coupling" of different social systems. He discusses this in the chapter on "Interpenetration" in his Soziale Systeme; cf. Luhmann (1984).

technical artifacts, technology is an enduring phenomenon. As part of second nature, it belongs to the environment of all societies; modern societies are additionally characterized by the interaction of their social subsystems with technology. The interaction between technology and social subsystems is not symmetrical; it is not the case that all three subsystems pull and push technology with the same power, in the same direction, or with the same success (see again 3.3.).

From this model, a "technological trajectory", but no technological determinism, can be derived. This is so for the following reasons. Every system operates according to its own rules and expectations about the operations of other systems. For example, the economy has to take into account that the legal context may change in the near future, that new scientific inventions will become available, or a technological solution. Politics may try to resist or enhance certain technologies, scientific work or economic activities. Science observes that a specific discovery would elicit massive financial rewards so concentrates on a specific research path. Each systemic operation takes time. Meanwhile, the Stoffwechsel takes place with technologies which are available. Small improvements and changes occur during their daily application. This explains the existence of a "technological trajectory". A technological revolution may occur either as a result of cumulative changes within a technological trajectory, or as a result of scientific discoveries which become applicable to transformation processes. However, technological determinism is excluded, since there are economic, political and scientific incentives at work, which lead to a change of technology. In Maturana's words, the "medium" can only select structural changes within the systems, it cannot determine them:

> "Wenn der Organismus und sein Nervensystem geschlossen und somit strukturdeterminierte Systeme sind, und wenn sie außerdem

> strukturell dynamische Systeme in dem Sinn sind, daß ihre Strukturen sich aufgrund ihres eigenen Operierens ständig verändern, dann kann eine Interaktion in ihrem Medium Strukturveränderungen lediglich selektieren, nicht aber festlegen." (Maturana 1982:20).

This model might also be read in the light of the 1859 Preface where the medium would be the productive forces and the systems would be the relations of production. Several points need mentioning here:

1. The concept of "relations of production" lacks precision. It encompasses economic, legal and social meanings. In order to make it more precise, it should be decomposed into its constituent parts.

2. The concept of superstructure is misleading since it uses a metaphor which suggests a picture of a building with more and less important floors. It suggests that the base (ground floor) could exist without the superstructure (first floor).

3. Cohen's interpretation tries to avoid some of the difficulties by proposing a functional relationship between the elements. Thus we have a primary layer of productive forces which explain the relations of production which explain the superstructures. But superstructures stabilize relations of production which in turn stabilize productive forces. This functional analysis fails on the grounds of its own premiss i.e. to explain productive forces in asocial terms.[282]

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282 See Lukes for a similar critique of the separation of the superstructure from the base, see Lukes (1983).

4. My own position, in contrast, concurs with the approach that there are some functional links involved in Marx's model but it defines the units in a different way. The most important difference is to rob technology of its autonomous status; in my view, only social systems enjoy such a position. Moreover, social systems fulfil also the requirement that they can be defined independently from each other. Circularity is involved in their self-production (which is no defect of the theory!), but is not involved in the relation between them. Yet, the question remains: which productive forces will be suitable for communism? Will they take the form of machinery which per definitionem degrades man to an appendage? According to evolutionary theory, a new, "liberating" technology cannot be brought about by intentional action alone, rather, its hypothetical emergence would be the result of the interplay of the economic, political and scientific system.

4.3.4. Summary

On a Weberian account, as briefly pointed out in 4.2.3., an elective affinity between capital, machinery and science obtains which explains the fusion of these elements in capitalist society.[283] On the basis of Eigen and Schuster's account, this process can be described as a hypercycle. Stripped to its essentials, manufacturing and machine technology, movable capital, propertyless workers, competition and extension of intercourse are the elements of the hypercycle. Capital is the self-replicative unit, the others are "catalytic links". According to autopoietic theory, capitalism is a social system which reproduces itself; it reproduces the system

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283 This is, of course, not Weber's precise thesis, which, as is known, analyses the relation between religions and economic forms.

by the production of its elements and it produces its elements by its elements. Taking these three approaches together, we can state that neither in the model of elective affinities nor in the model of the "hypercycle" nor in the theory of "autopoiesis" technology can an autonomy be assigned.

4.4. An empricial illustration: the transition from feudalism to capitalism

In this section, I trace some of Marx's analysis with respect to the transition from feudalism to capitalism, thereby also showing that a causal analysis is not feasible.

Marx never developed fully an historical account of the emergence of capitalism. He was mainly interested in the logical preconditions of capitalist production. Thus he restricted his historical sketch in the end of Capital 1 to demonstrating how capital and labour power came into existence. However, there are some pages in the German Ideology (see CW 5:66-81) and in the Grundrisse which can be exploited for my purposes here (I shall rely mainly on the passage from the German Ideology).

In the German Ideology, Marx gives an outline of the dynamics of capitalist production under the regime of the guilds and other feudal bonds. Marx's account takes as its premise an ever greater division of labour which separates town and country, commerce and industry, and branches of industry. The result is the extension of communications[284] which are particularly important for the development of the productive forces.

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284 The German "Verkehr" is usually translated as "intercourse".

> "As long as there exists no intercourse transcending the immediate neighborhood, every invention must be made separately in each locality... In primitive history every invention had to be made daily anew and in each locality independently." (CW 5:67)

With the establishment of the world market and large-scale industry, "the permanence of the acquired productive forces [is] assured" (CW 5:67), Marx assumes.[285] However, the empirical starting point for the evolution of capitalism is the manufacture of weaving. This first and most important branch of manufacture uses machinery. The rising demand for clothing gave weaving a big stimulus. A new class of weaver came into existence in the towns. Because of its very nature "weaving resisted the trammels of the guilds"; it was carried on mostly in villages and market centres without guild organisation. Merchant capital, and capital of manufacture, created a mass of movable capital. At the same time, peasants and vagabonds provided the army of the workpeople. The discovery of America and of the sea-route to India led to a new impetus for manufacture; the import of gold and other precious metals gave an additional stimulus to the creation of movable capital. Commerce and navigation led to the establishment of the world market, albeit in a restricted form, because of its splitting up into separate parts, each of which was exploited by a particular nation. Real competition between nations was prevented.

Marx distinguishes the above two forms of manufacture and commerce as two distinct historical periods. The third period, then, is large-scale industry. It had to respond to the ever-increasing

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285 Somewhat naively, we might add today, standing on the shoulders of Merton. As Douglas (1986) has pointed out, multiple discoveries and institutional forgetting are complementary processes which also take place in modern times.

demand for manufactured products. According to Marx, several preconditions must be fulfilled for this mode of production: application of natural powers in industry, machinery, a huge division of labour, freedom of competition inside the nation and the development of theoretical mechanics. We may interrupt Marx's outline at this point and ask ourselves: what sort of explanation, if any, is employed? Let me try to provide an interpretation.

Marx gives an account of how a new form of production drives out another form: "Hence the decline of the guilds as soon as they come into contact with manufacture." (CW 5:70). This seems to be an argument on the level of selection. Taking Elster's five points from above, and equating (Y) with the advent of manufacture, (X), with some needs of feudal society, (Z), we then have to ask how condition (5), i.e. the feed-back loop by which Y maintains X through Z, can be fulfilled.

At first sight, there seem to be many causal relations at work: needs giving a 'stimulus', discovery of America providing the 'impetus' etc. On the other hand, Marx speaks of preconditions for this development (freedom of competition, natural sciences, machinery, wage-labour). But these preconditions are themselves products of historical processes. Whatever these are, we are not able to identify a prime mover (or first cause) which sets into motion the whole process. Besides, the picture does not resemble a chain-reaction, but, rather, a network in which all elements influence all the others. It seems as if increasing demand ("human needs") is the motive power behind the whole. But since demand is only effective as economic demand, there must be a prior income which then can show up as demand. It thus seems as if we are lost in vicious circles and infinite regresses: capitalism still does not get off the ground.

Let us therefore change the text for a moment. In Capital 1, Marx tells us that English feudal lords tranformed their agricultural land into pastures for sheep to graze which in turn was caused by the flourishing of Flemish wool manufacture, followed by a consequent rise in wool-prices. In fact, the whole "clearing of estates" created a propertyless class of free labourers. But apart from the economic motivation (i.e. Dutch competition), there is a political factor (the dissolution of feudalism) and a religious-political factor (the dissolution of the property of the Church).

We still do not get a coherent explanation. Every string we catch dissolves into many fibres; every line we follow reveals itself as a circle.[286] The most reasonable approach would thus be to take the preconditions of capitalism as historically-contingent and analyze only the self-enhancing processes which eventually created modern capitalism.[287] Since his theory tells him that the capital-labour-relation is essential to understand capitalism, Marx restricts historical analysis mainly to the point where the emergence of those two elements (and their constitution as a social relation) takes place.

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286 Neo-darwinian biology seems to have the same difficulty in explaining how the "closure" of the hypercycle is brought about. "Die zwangsläufig folgende Frage, wie der Zyklus sich schließt, wie es zum 'Hyperzyklus' kommt, wird in der Literatur meistens in relativ großen Sprüngen beschrieben." (Ballmer and von Weizsäcker, 1984:241).

287 Marx would probably have insisted on a more law-like account. In the Grundrisse, and Capital, he establishes some evolutionary stages of the development of social forms which emerge from each other "out of necessity". But it is not clear whether this applies also to technical forms i.e. whether production based on artisanship had to give way to manufacture and only to manufacture.

And yet there seems to be a privileged element in Marx's account. This is technology. He starts the historical sketch in the German Ideology with a glance at the division of labour. He states that the biggest division between manual and mental labour is the division between town and country. In the countryside, outside the control of the guilds, evolves the system of manufacture.[288] Marx knows with Hegel and Adam Smith that manufacture with its division of labour is far more efficient than the earlier system of craftsmanship.[289] But the guilds prevented manufacture from growing up. Here we have an example for Marx's claim that social institutions may "fetter" productive forces. Historical evidence told him that the drive of the productive forces is stronger than the repression of social institutions. The guilds were simply by-passed and had to bow later before the rise of manufacture. This is the "technological bias" in Marx's analysis. However, technology is always embedded in specific social relations, in this case within the capital-labour relation. I thus conclude that it was part of Marx's implicit research programme to examine social

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288 When he describes the emergence of movable capital, of wage-labour, of competition and of the establishment of a "cash nexus" (X for short) he always presents it in the form of "With the advent of manufacture, X also occurred". These are clearly concomitant processes which are not caused by manufacture although it may seem that manufacture was the "subject" of this process. In the Grundrisse, he speaks of a process of dissolution which brought about the elements or preconditions for capitalism (see Grundrisse:496 ff.).

289 See the famous pin-making example of Adam Smith as cited in Hegel's early Jenaer Systementwürfe: "[A]n einer Stecknadel arbeiten in einer englischen Manufactur 18 Menschen; jeder hat eine besondre und nur diese Seite der Arbeit; ein einzelner würde vielleicht nicht 20; nicht 1 machen können; jene 18 Arbeiten unter 10 Menschen vertheilt machen 4000 des Tags; aber auf die Arbeit dieser 10, wenn sie unter 18 arbeiteten, würden 48000 in einem Tag kommen." (Hegel 1975:323).

relations and productive forces in their co-evolution. A confirmation is the transition from manufacture to Modern Industry. As already noted, Marx here assigns a degree of importance to social factors (see Capital 1:347;361 and MEGA II.3.6.:1973).

But to come back to the functional analysis: what sort of relations of production were functional for the development of the productive forces? As we have seen, in manufacture (and even more in large-scale industry) the capital-labour relation was the important, dynamic social relation. Relations of production which are functional for this relation must thus secure: (a) private property in the forms of free labour and free capital; (b) free market competition; (c) an institution which secures both (a) and (b) viz. the modern state.[290]

However, Marx does not stop with this account. Within the technical form of manufacture a new technology arises which will take the place of the old: this is large-scale industry based on machinery. Manufacture already used machines in its production process. Eventually, manufacture also produces machines which are able to produce machines. Once this task is accomplished - manufacture has performed its "historical service" - it becomes superfluous. The new productive forces of modern industry no longer depend on crafts of any sort. This is certainly a suggestive picture

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290 On this analysis the democratic form of the modern state is a contingent event. To be functional for the productive forces, it is sufficient to secure private property and competition. To be sure, there are historical reasons which made the democratic form of the state necessary e.g.s. the anti-feudal, anti-authoritarian, pro-science and, in some countries, pro-enlightenment conjuncture. See also Barrington Moore's analysis, (Moore 1966), which stresses the importance of class-constellations for the final shape of specific political forms of capitalism.

which has not lost any of its power. But perhaps Marx was led astray by the implicit suggestion that machinery itself was self-reproductive. In the language of Eigen and Schuster, it would have evolved from a "functional linkage" into a "self-replicative unit". But there are severe theoretical difficulties in supporting such an assumption not to speak of its lack of plausibility. Even a fully automated-industry, which employs robots instead of human labour power, cannot be said to be only produced by machines. This technology is also linked to science, politics and the economy.[291]

4.5. Evolution of technology and social institutions under ecological constraints

In the following discussion, I want to come back to the question of historical progress and the criteria for measuring it (see 3.1.7.). First of all, I want to stress that under present conditions we are faced "with a new kind of 'contradiction between the development of the forces of production and existing social productive relations' which appears... in all industrial societies" as Schefold (1977:247, my emphasis) so aptly put it.

If we accept the terminology of the 1859 Preface, we can no longer assume that modern societies have to adapt their institutional arrangements to the productive forces but that they have to attempt to shape the productive forces in a way which makes their detrimental effects upon the natural environment and upon human

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291 It is a common theme in science fiction to assume the contrary i.e. technology completely beyond the control of social relations. This persistent metaphor takes its force from a deep anthropological "fear" of the machine. The machine is something between the living and the dead; cf. Bahr's stimulating book (1985).

beings decrease. The social institutions and the productive forces have to become reflexive if the original claim of development and progress is to be sustained.

Traditional marxist analyses assumed that the institutional change would be tantamount to the abolishing of private property relations. This solution is fatally flawed in the light of ecological problems.

But not even a sophisticated author like G.A. Cohen offers these considerations sufficient room in his interpretation of historical materialism.[292] We would be badly advised to adopt his outline for the discussion of ecological problems since it offers only the perspective that class struggle might fight out the contradiction between productive forces and relations of production until new social relations have been established which are propitious for the productive forces. But it seems that in the case of ecological problems it is the very nature of some productive forces which causes considerable ecological damage. Hence, if we would rely on their "autonomous" development, we would be left witnessing even more disasters.

Late capitalism is still characterised by a "frightening" productivity, to use Bahro's expression (cf. Bahro 1977:9, 51). If we judge the performance of capitalism on the basis of economic or technical criteria (productivity), there is no reason to assume that a new social form would be required to "unfetter" a development of the productive forces. Marxism, interpreted in such a scheme of productive forces/relations of production, loses all of its critical impetus. However, in my opinion, there is still much

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292 I say "sufficient" because there is a degree of awareness of the problem (see infra).

justification for claiming exactly such a critical dimension for Marxism. In order to do so, another theoretical frame will be needed. As I have pointed out, it is crucial for such an approach to incorporate non-economic criteria into our standards of measuring progress. Since Marx did so, we have the possibility of endorsing this dimension in judging how successful a mode of production is in transforming nature.

It is not the institution of private property which fetters the development of the productive forces; and, on the other hand, it is not the institution of state planning which has lead to an unfettered development of the productive forces either in the wide (domination of nature) or in the narrow (economic) sense. Ironically, the history of the last seventy years has shown that it is still the capitalist arrangement which develops the productive forces (at least in the narrow sense) best. And, even worse for the performance of socialist planning, the socialist arrangement of the productive forces did not prevent the emergence of severe ecological problems. If socialist countries had a slower development of productive forces, it was <u>not</u> because they adopted an ecological policy which consumed part of the resources necessary for the development of the productive forces.

Marx employed ethical and physical arguments when judging historical forms of society. With respect to the first, he stated unequivocally that people were happier in previous modes of production:

> "Die Bedingungen, unter denen das [Kapital-] Verhältniß ursprünglich erscheint, oder die als historische Voraussetzung seines Werdens erscheinen, zeigen auf den ersten Blick doppelseitigen Character - auf der einen Seite Aufloesung niedrigerer Form der lebdendigen Arbeit - auf der andren Seite Aufloesung glücklichrer Verhältnisse für den unmittelbaren Produzenten. Einerseits Aufloesung von

> Sklaverei und Leibeigenschaft. Andrerseits Aufloesung der Form, worin die Productionsmittel unmittelbar als Eigenthum des unmittelbaren Producenten vorhanden sind, sei es daß seine Arbeit vorwiegend auf Gebrauchswerth (Agricultur) oder Tauschwerth (städtische Arbeit) gerichtet ist. Endlich Aufloesung der Form des Gemeinwesens, worin der Arbeiter als Organ dieses naturwüchsigen Gemeinwesens zugleich Eigenthümer oder Besitzer über seine Productionsmittel gesetzt ist." (MEGA II.3.6:2288)[293].

With respect to the second problem, he held quite an optimistic view, as we saw in chapter 2. Capitalism, he thought, displays the inherent tendency to recycle waste if it is cost-reducing. On the other hand, things which have no price are likely to be wasted under capitalism - examples are air, water, and most importantly, human beings. It is their flesh, blood and nerves which capitalism wastes in an unprecedented way.

Considering the present conditions of industrially-developed countries, this account seems to be questionable; but I claim that the premise on which it is built is still valid. The premise is the following: out of a given set of costs, capitalists try to reduce each factor, be it labour or raw material. This premise is as valid today as it was a hundred years ago. The difference lies in the different structure of costs (relative prices). In Marx's

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293 Cf. the early formulation in the Holy Family: "In the modern world each person is at the same time a member of slave society and of the public commonweal. Precisely the slavery of civil society is in appearance the greatest freedom because it is in appearance the fully developed independence of the individual, who considers as his own freedom the uncurbed movement, no longer bound by a common bond or by man, of the estranged elements of his life, such as property, industry, religion, etc., whereas actually this is his fully developed slavery and inhumanity." (CW 4:116) See also Rosdolsky (1968:488 ff.).

time, labour was a relatively cheap factor which has now become much more expensive. Raw materials, on the other hand, have not become cheaper in general: some raw materials have become cheaper, some more expensive, some are free (or nearly free), as they were in Marx's time (air and water). Certainly, labour has become protected by law. It therefore cannot be wasted in the same way as it could a hundred years ago. On this different empirical basis, we obtain results different from Marx's. Today we witness the depletion of natural resources which are only partially recycled, apart from animal species made extict. It goes without saying that only the relatively expensive raw materials are recycled by capitalists.[294] The cheap ones are wasted. It is completely rational for a capitalist (as for a private consumer) to throw away what would require some labour time to restore its use-value if he can readily buy the material at a comparatively low price. If a capitalist has the alternative of buying one ton of a metal or of extracting it from a salt which comes out as waste from his production process, he will decide on the basis of relative prices. Similarly, the private consumer throws away his TV set when costs of repair exceed a certain percentage of the costs of a new TV set.

At the same time, we observe another tendency in this process: the tendency to substitute expensive raw materials with cheaper raw materials. The result of this is that man to an ever greater extent mediates his Stoffwechsel with nature by a process which transforms nature ('raw material') into artifacts. Ecologists doubt that this success in transforming nature is a rational one. If one compares the efficiency of production as an economic process with its efficiency as a technical process in so far as it

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294 I do not consider here public recycling of paper, glass etc.

involves energy, we may find that there is a discrepancy (see Schefold 1977). In fact, if societies do not succeed in providing enough cheap energy to maintain its present system of nature transformation based on economic rationality, the 'Development thesis' would not hold true, because in this case mankind would have to retreat to a 'lower' state of development (in the sense of economic rationality): it would have to produce by using more labour inputs. The rationality assumption would thus turn out to be false, or at least lead to non-rational outcomes. In order to avoid such a result, economic rationality would have to be substituted, or supplemented, by an energy-conscious rationality. As we have seen, Cohen's 'Development thesis' rests on the sole variable of material wealth, which in the context of the present work certainly is not a sufficient one. Cohen, at the very end of his book, dedicates some attention to this problem. He admits that "if resources are to be used more sparingly, recourse to them must to some extent be replaced by continued reliance on human labour power... (Cohen 1978:323) Is this a reason to be pessimistic about post-capitalist society, since the promise of increased leisure cannot be fulfilled? Not at all, replies Cohen. Such pessimistic "reflections depend on a crude concept of leisure... By 'leisure' we have meant freedom from unwanted activity, not freedom from productive activity. That the two have gone together under capitalism does not mean that they are fated to coincide in the future." (Cohen 1978:323) As we shall see in the next chapter, this distinction is an illuminating one, but one with which Marx was already familiar.[295]

Victor (1980) also maintains that Marx's framework entails the physical dimensions of economic processes. After criticizing

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295 It thus does not run "against a deep current of thought in Marx", as Cohen supposes (cf. Cohen 1978:323).

neoclassical economics for its blindness with respect to ecological problems, Victor holds that Marx's "broadly conceived analytical framework is not open to the same criticism ... that can be levelled at the neo-classical framework." (Victor 1980:207). Neoclassical economics have had only one major contribution which recognized the problem; this was Kenneth Boulding's article "The Economics of the Coming Spaceship Earth". As Victor put it, Boulding "pointed out that the economic activities of consumption, production, and trade involve a rearrangement of matter and not a creation of new material." (Victor 1980:198). But this approach is hardly new for someone familiar with Marx's theory:

> This new approach to economic activities is particularly insightful for analysing environmental issues. It may be surprising to discover, therefore, that in fact it is not really a new approach at all. Economists as distinct in their orientation as Alfred Marshall and Karl Marx devoted substantial passages in their respective treatises to a description of economic activity in precisely these terms." (Victor 1980:198)

This leads me to the core of Marx's theory. I maintain that Marx throughout his work endorsed an ethical theory on which his analysis and scientific edifice rests. This ethical theory can be summed up in the following way:

Marx's main concern regarding mankind as a whole, and individual human beings, was to search out the possibilities for an abolition of all "enslaving effects" which would fetter the development of individuals in a universal way. For example, he writes in the Theories of Surplus Value that people under capitalist conditions are "dominated by the pressure of an extraneous purpose which must be fulfilled, and the fulfillment of which is regarded as a social duty." (TSV III:257) In the Grundrisse, Marx defines "real wealth" in terms of individual self-realization, a process which

includes an increasing domination of nature and is at the same time an ongoing process i.e. a process which has no halting point. This passage synthesises his philosophical anthropology with perfectionism and his conception of emancipation:

> "[W]hen the limited bourgeois form is stripped away, what is wealth other than the universality of individual needs, capacities, pleasures, productive forces, etc., created through universal exchange? The full development of human mastery over the forces of nature, those of so-called nature as well as of humanity's own nature? The absolute working-out of his creative potentialities, with no presupposition other than the previous historic development, which makes this totality of development, i.e. the development of all human powers as such the end in itself, not as measured on a predetermined yardstick? Where he does not reproduce himself in one specificity, but produces his totality? Strives not to remain something he has become, but is in the absolute movement of becoming?" (Grundrisse:488).

Social division of labour in class societies is most likely to initiate extraneous purposes. Marx, writing on a future communist society in the Critique of the Gotha Programme, asserts that "in a higher stage of communist society, ... the enslaving subordination of the individual to the division of labour, and therewith also the antithesis between mental and physical labour [will have] vanished..." (SW 3:19). As we have already seen, Marx thought that people were happier in earlier modes of production (MEGA:II.3.6.:2288) and also freer (CW 5:78-9). But pre-capitalist conditions where the worker owns his means of production, typically exclude (a) concentration of means of production; (b) cooperation; (c) division of labour within one production process; (d) social mastery and regulation of nature; (e) free development of social productive forces (see Capital 1:714).

Marx thought that it is possible, probable and even inevitable that mankind will reach an non-enslaving mode of production in socialist society. Socialist society would synthesise the moral level of ancient societies with the achievements of modernity; it would combine the concern for use-value production (quality of products) of antique society with the general availability of commodities in modern capitalist society (quantity).[296] In the Grundrisse, he says that only under modern conditions does an interest arise in what sort of property yields maximum wealth; in ancient Greece, the interest was in which sort of property yields the best citizen (cf. Grundrisse: 487).

The historical condition for the fusion of 'happiness' with 'material wealth for the greatest number' would be a sufficient level of productive forces which frees man from wrestling with nature to a large degree. Capitalism was the mode of production which served this purpose. Thus Marx praised capitalism for the development of the productive forces. But capitalism still does not bring about a full "social mastery and regulation of nature". People still are the pawns in a mechanism which they do not understand. As Marx emphasises, there is a paradoxical tendency at work:

> "In our days, everything seems pregnant with its contrary. Machinery, gifted with the wonderful power of shortening and fructifying human labour, we behold starving and overworking it. The new-fangled sources of wealth, by some strange weird spell, are turned into sources of want. The victories of art seem bought by the loss of character. At the same pace that mankind masters nature, man

296 In the Manuscripts Marx examines ancient Greek thinkers like Xenophon, Plato, Aristotle and Thucydides. They were concerned with the quality of products (use-values); therefore, it was assumed that each man should dedicate himself only to one art or work.

> seems to become enslaved to other men or to his own infamy. Even the pure light of science seems unable to shine but on the dark background of ignorance. All our invention and progress seem to result in endowing material forces with intellectual life, and in stultifying human life into a material force." (CW 14:655-6)

This paradoxical tendency, this regress within progress, made Marx condemn capitalism. It is a social form which makes people suffer, which has an irrational performance (economic crises) and reifies social relations. This condemation is a moral condemnation, even if Marx refused to accept such a label.[297] It is a moral condemnation, because someone who is interested exclusively in the level of productive forces has no reason to condemn the social form which is beneficial to that development, if this

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297 He often endorses an ironic attitude, as when he cites Goethe's poem "An Suleika". Marx refers several times to this poem. He attributes it to the propagators of capitalism and to the capitalists themselves when he exposes the misery produced by capitalism. Confronted with the number of dead workers in mines, they would, according to Marx, respond with the poem which reads as follows:

> Sollte diese Qual unse quälen,
> Da sie unsre Lust vermehrt,
> Hat nicht Myriaden Seelen
> Timurs Herrschaft aufgezehrt?

Marx, in turn, uses the same poem in the opposite sense, stressing above all the 3rd and 4th verses which refer to the expectation of a socialist revolution. This use of the poem is a clear instance for Marx's view that history until the advent of socialist society is a natural process in which it takes a certain number of souls which have to be sacrificed in order to achieve the downfall of the tyrant. Of course, one can characterize this position as simply describing ("value-free") a mechanism; but only the underlying evaluation (sacrifice, tyrant) provides meaning (for the social scientist) and motivation (for the oppressed masses).

social form goes along with a development of the productive forces both on average and in the long run. If the setbacks are only temporary or so small that they cannot reverse the general direction of the development of the productive forces, there would be no reason to object to such a development. But Marx is not concerned about "net gains" of the sum total of progress and regress. The point is that both notions have many dimensions which make it difficult to scale or quantify them.

The fact that Marx did condemn capitalism for these very 'setbacks' reveals clearly the existence of another criterion besides the 'productivist' one. To repeat, this criterion is an ethical one.[298]

If we accept this interpretation of Marx's theory, we are in a better position to pose the question of ecological problems and the level of productive forces again. Now, if Marx's ultimate concern was the abolition of enslaving effects and to bring about a social form which organises its transformation of nature in a rational way, he would have had to take into account the possibility that man's very Stoffwechsel with nature entails the

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298 Marx does not share the criticisms of modernity which would like to abolish modern technology and modern conflicts. Against such backward-oriented positions, Marx says: "On our part, we do not mistake the shape of the shrewd spirit that continues to mark all these contradictions. We know that to work well, the new-fangled forces of society, they only want be to be mastered by new-fangled men - and such are the working men. They are as much the invention of modern time as machinery itself." (CW 14:656) Nietzsches's Übermensch comes to mind here, but also Marx's dictum that people only set themselves tasks which they are able to fulfil. The emergence of Marx's "superman" is a process which can be determined technologically: since the productive forces of capitalism are universal ones, the producers who reappropriate them are becoming universal individuals.

danger of 'enslaving effects'. Marx seems to overestimate the degree of a successful social mastery of nature under capitalist conditions. He is indeed aware of severe ecological problems which arise as a cause of capitalist conditions. However, we may doubt if Marx's own position offers a perspective here. As he states in Capital, a higher synthesis of agriculture and industry would avoid disturbances in the process of Stoffwechsel (see Capital 1:474). This is consistent with his view in the German Ideology that the division between town and country would have to be superseded in communism. In this respect, modern reality does not seem to fit his plea: there are industrial, agricultural and undeveloped areas on the planet. In some regions, the distinction between town and countryside has vanished, but not necessarily to the benefit of its inhabitants. At least in industrially developed countries people who live in the countryside are less and less farmers but simply people who prefer living outside the towns.

Nevertheless, it is modern industry which frustrates such a higher synthesis: "The more a country starts its development on the foundation of modern industry, like the United States, for example, the more rapid is this process of destruction." (Capital 1:475). This is another instance where Marx seems aware of the possibility that the very nature of a productive force might cause huge undesirable effects i.e. that it is not only the capitalist form which is responsible (see 3.6.). But this would create insurmountable difficulties for his theory. He thus adds immediately:: "Capitalist production, therefore, develops technology... only by sapping the original sources of all wealth - the soil and the labourer." (Capital 1:475). With respect to the detrimental effects of modern industry on human labour power, Marx tried to make his analysis consistent in the final version, i.e. in Capital, as we have seen in 3.6. With respect to detrimental effects of modern industry on the natural environment, Marx's

analysis remains ambigous: it allows for both possibilities, blaming the productive forces and social relations.[299]

According to Marx, a social mastery of nature can be achieved only in communism. As he states in Capital, a higher synthesis of agriculture and industry would avoid "disturbances" in the Stoffwechsel between man and nature. This is consistent with his view (as expressed in the German Ideology) that the separation between town and country will be overcome by communism. The miserable state of the natural environment, the separation of the globe into agricultural and industrial zones, the dangers arising from the present methods of transforming nature indicate clearly that mankind has not yet succeeded in mastering nature. We may thus regard the solution of ecological problems as a test case for communismi.e. only that social form which succeeds in incorporating reflexivity into its modus operandi will be worth being called "communist".

The actual presence of ecological problems motivates my attempt to reformulate Marx's theory in this respect. A reformulation would read in the following way: higher levels of productive forces are not sufficient for communism to be superior to capitalism. To be superior, communism has to ensure not only the development of the productive forces but also the abolishing of enslaving effects which stem from technology. Communism will be

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299 Recall Marx's statement on the "greedy farmer [who] snatches increased produce from the soil by robbing it of its fertility." (Capital 1:253). Also, here, it is not a specific social relation (for example, capitalism) which exhausts the soil but a behaviour which may occur under several social relations, under relations which exacerbate a greedy attitude towards nature.

the first form of human society in which mankind has reached "mastery over nature".

This formulation has another form as Marx's famous statement in the 1859 Preface, and as formalised by Cohen. As Ernst Bloch observed, all rejoice about great technical progress is in vain because progress in technology can be accompanied by regress in society (cf. Bloch 1959:814).

Marx did not pay enough attention to the possibility that technological and scientific progress need not be parallelled by social progress. He partly followed the optimistic tradition of the Enlightenment (Bacon, Descartes) which assumed such a parallel (see Leiss 1972). But Marx was also deeply influenced by (German) romanticism. This tradition informed his theory of moral evolution of mankind (from a non-alienated primordial state to personal dependence, to impersonal dependence to total freedom.[300] Since Marx took for granted that history would inevitably lead to a final reconcilation in communist society, he could formulate the relation between productive forces and social institutions as an objective relation. If we, basing ourdelves on historical evidence, challenge this assumption, we can nevertheless derive the

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300 See Grundrisse: "Relations of personal dependence (entirely sponateous at the outset) are the first social forms, in which human productive capacity develops only to slight extent and at isolated points. Personal independence founded on objective dependence is the second great form, in which a system of general social metabolism, of universal relations, of all-round need and universal capacieties is formed for the first time. Free individuality, based on the universal development of individuals and on their subordination of their communal, social productivity as their social wealth, is the third stage." (Grundrisse:158).

criteria for the superiority of communism from Marx's own framework: only a society which is able to calculate the results of its own working fulfils the condition of being a communist society.

CHAPTER 5: COMMUNISM

> Sinnlos daher, von Erfinden, das für sich allein steht, ein sicher Gutes zu erwarten. Es ist nicht immer besser als die Gesellschaft, die es setzt und gebraucht.
>
> Also können Fortschritten der 'Naturbeherrschung' sehr große Rückschritte der Gesellschaft entsprechen, auch die 'Naturbeherrschung' sieht dann danach aus.
>
> Ernst Bloch

5.1. Two faces of communism

One conclusion which I have reached so far is that a communist society must be a society which regulates its interchange with nature in a rational way; this is to say that the existence of severe ecological crises would inhibit calling such a society "communist". This proposition follows from Marx's insistence that human emancipation does not only mean material abundance and non-existence of wage-slavery but also spiritual wealth (happiness) and conscious control of the individuals over their life-conditions. In what follows I shall focus on a possible ambiguity in this notion of communism. The ambiguity is contained in the last proposition: all depends how strong a claim is made with respect to conscious control and how the realm of "life-conditions" is defined. My suggestion is to distinguish between two notions of communism. If we summarise some remarks of Marx with respect to communism in general, we could compile the following list:

1. abolition of private property;
2. abolition of classes, class-exploitation and class-oppression;
3. universalisation of happiness;
4. universalisation of material wealth;
5. expanding of disposable time;

6. return to use-value production;
7. reappropriation of man's objectifications;
8. total individuals;
9. conscious control.

The dividing line lies somewhere between 5 and 7. The difference between the two notions can be connected to the principles of market and plan and to the presence or absence of alienation and fetishism.[301] Whereas the strong notion requires the superseding of alienation, the weak notion would allow its persistence. I return to this difference in 5.5.2. and 5.6.

In the Paris Manuscripts, Marx himself gives a hint of such a distinction: here he says: "Communism is the necessary form and the dynamic principle of the immediate future, but communism as such is not the goal of human development, the form of human society." (CW 3:306)[302]. In his later writings he equates the release of all human powers with communism. Nevertheless, there is still a tension within his concept of communism. For example, in his Critique of the Gotha Program, Marx introduces a lower stage of communism, which by later Marxists has been called socialism (cf. Lenin 1917:472). With this distinction we have again a weak and a strong notion of communism. But before discussing this possible tension, I shall first look at decisive traits of communism "as such", as described by Marx.

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301 For a distinction see 3.5.

302 Maihofer (1968) points out this possible difference. It is possible that Marx here refers to "crude communism", a notion which he used in the Paris Manuscripts, too. See also Avineri (1968).

In the Comments on James Mill, (1844) Marx defines the "human society" as a society which makes possible the full release of human nature:

> Let us suppose that we had carried out production as human beings. Each of us would have in two ways affirmed himself and the other person. ...I would have directly confirmed and realized my true nature, my human nature, my communal nature. Our products would be so many mirrors in which we saw reflected our essential nature. (CW 3: 227-8)

Marx contrasts production under capitalist relations with 'production as human beings', where the latter is a synonym for communism. Human beings are charcterised as creative and communal beings. Capitalism thwarts the full development of the individuals, although - at least according to the "official" position developed in Capital - it contributes to that development in so far as it enhances the variety ("Vielseitigkeit") of work and creates the social-cooperative character of work. A society which enabled the release of all human powers would be 'the human society'.

Marx approaches the project of emancipation not from a given "system of happiness" but rather from the features of human nature. The first approach would be a static and doctrinal one, whereas the second starts from empirical facts and scientific observation viz. that human beings have developed their productive powers i.e. their domination over nature. Humans were, and are, able to do so because they are creative and communal. They develop new productive forces within social relationships. This approach gives Marx clear criteria to judge historical forms of production, including the capitalist form. If a social form "fetters" the project of mankind to increase mastery over nature, it will be replaced by a social form better adapted to that need. The mecha-

nisms which bring about this replacement are equally historically-observable real forces. For Marx, then, the scientific and the normative view converge, since the abolition of capitalism is not only desirable but a "process which unfolds beyond our eyes" (as he put it in the Communist Manifesto)[303]. We have to interpret Marx in this context when, in Capital 1, he approvingly cites the monk Ortes of Venice, who said: "Instead of proposing useless systems for peoples' happiness, I shall limit myself to investigating the causes of human misery." (Das Kapital 1: 675-6, my translation). There can be no doubt that Marx saw the causes of human misery in the "fettering" instances of human nature: whenever the "promethean" trend of man was thwarted, human misery was the result. The reader will note that I am using the word "fetter" with a different meaning from the usual one. The locus classicus for the notion of fettering is the 1859 Preface, where it occupies a central place to describe the relation between productive forces and relations of production in the course of history. The standard interpretation of the 1859 Preface is mainly about economic criteria, about fetters to the optimal use or development of productive forces. But we must not forget that the productive forces which are embodied in specific technologies and forms of social cooperation are the "expression" or objectification of the creative individuals who strive towards a world which leaves no place for superior powers. This humanist model lies at the heart of Marx's discussion of the relation between productive forces and relations of production. It would be mistaken to interpret the Preface in mere quantitative economic

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303 Lukes (1985:37) interprets Marx as an "anti-utopian Utopian", claiming that Marx, "in quasi-Hegelian fashion, [is saying] that with the forward movement of history, a vantage point becomes available from which the self-transformation of capitalism into socialism becomes increasingly visible. Adequate knowledge of this process, though not of the shape of future society, becomes available to the scientific observer." (Lukes 1985:41)

terms. True, capitalism fettered the development of the productive forces in this respect, too (remember that this was Lenin's central claim in his theory of imperialism) and that Marx also criticised capitalism in this respect.[304] I say "also" because this was neither his sole nor his most important criticism. In 4.6., we saw that a spiritual element was always present in Marx's definition of "progress". We also saw that a successful Stoffwechsel between society and nature has to be included and that the Marxian theory offers the tools for such an analysis. After all, this is the crucial point for the whole debate between Marxists and environmenalists: if Marxism has a narrow, quantitative, "productivist" notion of what increase in the productive forces means, the environmenatlists' challenge of Marxism is completely in order. If, on the contrary, Marxism has a wider notion of the term (and I think it has) then the environmentalists' charge is not only misplaced, but the ecological problematique can be tackled by Marx's theory in an illuminating way.

In the German Ideology, we find a contrast between communism and all earlier modes of production:[305]

> Communism differs from all previous movements in that it overturns the basis of all earlier relations of production and intercourse, and for the first time consciously treats all naturally evolved premises [" naturwüchsig"] as the creations of hitherto existing men, strips them of their natural character and subjugates them to the power of the united individuals... The reality which communism creates is precisely the true basis for rendering it impossible that anything should exist independently of individuals, insofar as

304 See Elster's discussion of different possible meanings of "fettering".

305 Of course, Marx does not yet use the term "mode of production". However, as the context makes clear, he is not only talking about a communist (social) movement but about communism as a social form.

> reality is nevertheless only a product of the preceding intercourse of individuals." (CW 5: 81, my emphasis).

Note again that the word "natural" in the quotation does not so much refer to "nature", but is used in the sense of 'given', 'unchangeable', 'opaque'. Not only $nature_1$, but also $nature_2$ can thus have "naturally-evolved" characteristics. The more mankind succeeds in transforming nature, the less this is conceived as a mystical power but something subjugated to the power of the united individuals. This aspect of actively transforming nature becomes of crucial importance here and distinguishes Marx from Feuerbach's passive naturalism. For Marx, nature as such cannot be cognitively captured. As he put it with Vico, we can understand only what we have produced ourselves (see 5.5.1.).

In Capital, Marx again analyses 'natural premises' and the possibility of treating them as the creations of 'hitherto existing men'. In so doing, he employs the Stoffwechsel concept to analyse the relation of society to nature and conceives of human development in the circle of externalization, objectification and appropriation (cf. Habermas 1985). Under capitalism, the circle is interrupted, since the product of the producers does not return to them. Hence, to close this circle, private property needs to be abolished and labour has to be constituted as social labour from the outset. Marx presents four models of non-capitalist production. The first is Robinson's isolated production, the second is feudalism, the third is a patriarchial farmers' community, and the fourth is

> "a community of free individuals, carrying on their work with the means of production in common, in which the labour-power of all the different individuals is consciously applied as the combined labour-power of the community." (Capital 1:82-3).

Now, this "community of free individuals" is obviously a synonym for communism. Feudalism and the patriarchic family are both based on personal dependence, with the difference that feudalism rests on an enforced division of labour whereas the patriarchic family rests on a "spontaneously developed division of labour" (Capital 1:82). These rural-patriarchalic communities thus could almost be called communist, if they were not founded on the "immature development of man individually" which is reflected in the "ancient worship of Nature" (Capital 1:83,84). Historically, these communities have been eroded to the extent that personal dependence has given way to impersonal dependence, transforming labour-power into a commodity.[306]

Communism, for Marx, is thus a stage of society in which the united individuals[307] (freely associated men) act upon their material production and conceive their products as products of their own; not as products of nature, and not as mystical productsi.e. products of capital:

> "The life-process of society which is based on the process of material production, does not strip off its mystical veil until it is treated as production by freely associated men, and is consciously regulated by them in accordance with a settled plan." (Capital 1:84, my emphasis).

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306 I employ here the evolutionary scheme from the Grundrisse where Marx depicts a development of mankind from personal dependence to impersonal dependence to freedom, see Grundrisse:158. The full quote is given in 4.5., final footnote.

307 The notion of "individual" is a modern concept which emerges directly from the dissolution of relations of personal dependence, i.e. when labour-power is transformed into a commodity. In other words, members of a patriarchaic family are not "individuals" - they are parts of a collectivity.

"Natural character" and "mystical veil" are interchangeable in the quote from the German Ideology (CW 5:81, quoted above) and in the preceding quote from Capital - they fulfil the same function in his argument. When Marx says here that production must be "regulated in accordance with a settled plan", this can be interpreted as a more concrete formulation of the German Ideology's "subjugation of human creations to the power of the united individuals." Communism will be the historical stage under which men for the first time supersede the natural character of the Stoffwechsel. The preconditions for such a society are the establishment of the world market and the existence of a universal class: the proletariat.[308]

In this section I, touched upon three questions which need further examination. The first is the question of transforming nature and the cognitive possibilities which are required for a human society - a question which I discuss further in 5.3. and 5.5.1. The second is the question of how this "conscious control" will be organised. Does something like central state planning follow from Marx's theory? (5.5.2.). Closely linked to this topic is the third question: how are the weak and the strong notion of communism linked in Marx? (5.5.2. and 5.6.) But next I shall consider the

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308 Note that both preconditions refer to communicative aspects; the creation of the world market consists in the extension of means of transport and communication; likewise, the proletariat is a universal producing and suffering class which represents the interests of humanity. In contrast to earlier producers, the industrial workers are producing cooperatively, a fact which enhances communication. Comparing countries with different population density, Marx draws attention to the fact that a country with less density may compensate such a possible disadvantage with respect to productive power by means of communication. See Capital 1:333.

notion of labour which, according to Marx, forms the link between society and nature.

5.2. Labour

In this section I, focus on how Marx conceives of the character of productive activity in communist society. Is it true that he equated labour (as necessary, nature-transforming activity of the human race) with unwanted activity? Did he conceive of communist society as a society in which labour has been transformed into completely free activity? Is Marx's ideal of labour something close to "play"? In what follows I shall answer all these questions in the negative.

5.2.1. The critical dimension of the concept of labour

Human beings are natural and social beings. Their life-activity (Lebensäußerung) is thus not mere transformation of nature, but conscious and creative transformation of nature. This is what distinguishes them in the first place from animals, as Marx pointed out in the Paris Manuscripts:

> "Free conscious activity is man's species character... The animal is immediately identical with its life-activity... Man makes his life-activity itself the object of his will and consciousness... Conscious life-activity directly distinguishes man from animal life-activity... Admittedly animals also produce. They build themselves nests, dwellings... But man in the working up of the objective world... duplicates himself not only, as in consciousness, intellectually but also actively, in reality, and therefore he contemplates himself in a world he has created." (CW 3: 275-7).

Human beings are not only creative, but also communal. "The individual is the social being. His manifestations of life - even if they may not appear in the direct form of communal manifestations of life carried out in association with others - are therefore an expression and confirmation of social life." (CW 3:299)

Marx saw clearly that the present conditions of production (capitalist relations) impinge upon the full realization of these human characteristics. As he wrote in the German Ideology:

> Thus things have come now to such a pass that the individuals must appropriate the existing totality of productive forces, not only to achieve self-activity [Selbstbetätigung, R.G.], but, also, merely to safeguard their very existence... The appropriation of these forces is itself nothing more than the development of the individual capacities corresponding to the material instruments of production ... Only at this stage does self-activity coincide with material life which corresponds to the development of individuals into complete individuals [Totale Individuen, R.G.] and the casting off of all natural limitations... With the appropriation of the total productive forces by the united individuals, private property comes to an end." (CW 5: 87-8, my emphasis)

The abolition of these conditions would thus give rise to the realization of all human powers. This "expressivist" notion of labour (Ch. Taylor 1975) is present in all stages of Marx's theoretical development. It is most important to keep in mind Marx's concept of labour as self-creation of the human race.

5.2.2. Labour and Enjoyment

In my view Marx constantly employed an ideal of labour which was a combination of work and enjoyment.[309] An instance for this approach we can find, for example, in the Paris Manuscripts where he writes: "In political economy labour occurs only in the form of activity as a source of livelihood... [P]olitical economy knows the worker only as a working animal - as a beast reduced to the strictest bodily needs." (CW 3:241, 242). The alienated state of labour is constituted by "the fact that labour is external to the workeri.e. it does not belong to his intrinsic nature; that in his work, therefore, he does not affirm himself but denies himself, does not feel content, but unhappy, does not develop freely his physical and mental energy but mortifies his body and ruins his mind." (CW 3:274)[310]

In the German Ideology, writing about the relation between individuals and the productive forces, he states: "Labour, the only conncetion which still links them with the productive forces and with their own existence, has lost all semblance of self-activity and only sustains their life by stunting it." (CW 5:87)[311]

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309 My interpretation thus differs from that of most commentators, for example Moore (1980), Cohen (1978), Arendt (1958), Habermas (1976), Heller (1976). I agree, rather, with Avineri (1967).

310 Moore (1980:98-9) rightly lists authors like Aristotle, Rousseau, Schiller and Hegel who, like Marx, developed an ideal of labour which is linked to an ideal of human nature. In terms of political philosophy this is the tradition which endorses a notion of "positive freedom".

311 As Habermas rightly pointed out: "Marx darf das Prinzip der Arbeit freilich nicht zu eng fassen, wenn er im Begriff der Praxis auch den vernünftigen Gehalt der bürgerlichen Kultur und damit die Maßstäbe unterbringen will, anhand deren sich der Rückschritt im Fortschritt identifizieren läßt." (Habermas 1985:80)

The same general approach is to be found in the Grundrisse where he introduces the distinction between labour and play. Marx opposes Fourier who advocates a transformation of labour into play (see Grundrisse:712). He maintains that such a transformation would be impossible, and, furthermore, even the most free work (like composing) is a most serious activity (see Grundrisse:611).[312] But Marx also opposes the view of Adam Smith who regards all work as an 'oath' and views leisure as the ideal human situation. Against this position Marx puts forward his different anthropology: i.e. that man, in his "normal state of health, power, activity" has the need for a normal quantum of work and hence interruption of leisure.

> "In the sweat of thy brow shalt thou labour! was Jehova's curse on Adam. And this is labour for Smith, a curse. 'Tranquility' appears as the adequate state, as identical with 'freedom' and 'happiness'. It seems quite far from Smith's mind that the individual, 'in his normal state of health, strength, activity, skill, facility, also needs a normal portion of work, and of the supersession of tranquility." (Grundrisse:611).

Although the Grundrisse would be seen to turn away from the early writings because of their deliberate 'realist' tone against Fourier, instead they rather confirm the position taken there viz. that labour and enjoyment in principle can, and should, go together; in the Grundrisse, we find the formula of 'travail

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312 Benjamin in his Passagen Werk endorsed Fourier's vision, arguing that once human labour ceases to be exploited, nature also ceases to be exploited and hence work can become play: "Hört diese [Ausbeutung, R.G.] auf, so wird die Arbeit ihrerseits den Character der Ausbeutung der Natur durch den Menschen abstreifen. Sie wird sich dann nach dem Modell des kindlichen Spiels vollziehen, das bei Fourier dem travail passioné der harmoniens zugrundeliegt." (Benjamin 1982:456). I return to Benjamin in a moment.

attractif' for this fusion. Marx stresses the need human beings have for work, which may be done in an enjoyable way ('travail attractif') or in an fragmented, alienated, unhappy way (as under capitalism). But Marx clearly opposes the extreme position that labour could be transformed into play. (This Fourierian view employs the same anthropology as Adam Smith. Both regard human beings essentially as 'homo ludens' or at least having a strong 'leisure preference')[313].

Let us now examine the concept of labour in Capital. Marx starts with a theme which by now is familiar to the reader: man is part of nature, nature is man's inorganic body with which he must keep in contact in order to survive. This Stoffwechsel is therefore, in the first place, a necessity rather than a desire.[314] So far as "labour is a creator of use-value... it is a necessary condition, independent of all forms of society, for the existence of the human race; it is an eternal nature-imposed necessity, without

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313 Some anthropological research seems to confirm this view, see Sahlins, Godelier and others. But Marx also at times employs this view when he says that men were essentially forced to develop their productive forces, to work, etc. Ironically, on the same page of the Grundrisse as where he criticises Fourier, Smith and Proudhon, he writes: "Ursprünglich die freiwilligen Gaben der Natur reich, oder wenigstens nur anzueignen..." Either there is a gulf between Marx's anthropological assumptions and his historical materialism, or people in such low stages of productive forces were not able to engage in the exercise of their human nature.

314 Note that this approach is already present in the early writings and in the German Ideology: "The worker can create nothing without nature, without the sensuous external world. It is the material on which his labour is realised, in which it is active, from which and by means of which it produces." (CW 3:273)

which there can be no material exchanges between man and Nature, and therefore no life." (Capital 1: 50).

Some commentators have been led astray by this formulation.[315] There can be no doubt that Marx in Capital, too, endorsed a normative concept of labour. Admittedly, there are some passages in which he seems to praise modern factory work for itself. As my discussion in chapter 3 has shown, this appraisal had nothing to do with praising stupid, monotonous or repellent work. The extoling merely referred to the social, cooperative character of production which would serve as a foundation stone of communist society. He praised the capitalist mode of production for having abolished life-long attachment of one individual to one profession or branch of activity; he praised the tendency to develop more abilities, and, finally, the essentially cooperative character of industrial production.[316] On the other hand, Marx is aware of the deskilling and other harmful consequences of these tendencies under capitalist relations. Since Marx, in Capital, takes great pains to show that potential progress (both in the economic and spiritual sense of the term) is not set in motion as a result of capitalist social relations, it would be foolish for him to endorse a concept of labour which was devoid of any emancipatory element.[317]

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315 Agnes Heller maintains that Marx in Capital regards labour essentially as a social duty, not as a vital need (Heller 1976:110). I will address this contention in a moment.

316 I am not sure if Marx proposed here a "downright silly" position, as Elster (1985:81) suggests.

317 In this respect Hannah Arendt's critique of Marx seems to be misconceived; see also Honneth (1982).

5.2.3. The realm of necessity

Human beings, whether they want to or not, must participate in the Stoffwechsel with nature. With this argument, Marx seems to come close to Adam Smith. But does it really follow that he has to give up his concept of 'travail attractif'? A widespread view holds that Marx, at least in Capital 3, becomes more pessimistic and introduces the dichotomy of labour and leisure, where the first is alienated, the second free, conscious activity. The two are interpreted as corresponding to the realms of necessity and freedom and it is assumed that the early Marx dreamt of communism as the "realm of freedom", whereas the later Marx came to acknowledge some undelightful necessities. I think that such interpretations are completely misconceived.[318] Since the famous passage from Capital 3 has - to my mind - caused considerable confusion among many commentators, I shall devote some attention to it. Marx says:

> "In fact, the realm of freedom begins only where labour which is determined by necessity and mundane considerations ceases; thus in the very nature of things it lies beyond the sphere of actual material production. Just as the savage must wrestle with nature to satisfy his wants, to maintain and reproduce life, so must civilized man, and he must do so in all social formations and under all possible modes of production. With his development this realm of physical necessity expands as a result of his wants; but, at the same time, the forces of production which satisfy these wants also increase. Freedom in this field can only consist in socialised man, the associate producers, rationally regulating their interchange with nature, bringing it under their common control, instead of being ruled by it as a blind power; and achieving this with the least expenditure of energy and under conditions most favourable to, and worthy of, their human nature. But it nonetheless still remains a

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318 See, also, my own treatment in Grundmann (1988).

> realm of necessity. Beyond it begins that development of human energy which is an end in itself, the true realm of freedom, which, however, can blossom forth only with this realm of necessity as its basis. The shortening of the working day is its basic prerequisite." (Capital 3:820)

From this it follows very clearly that communism will never be a pure "realm of freedom" - but the younger Marx did not entertain such a belief either. Marx, both in the 1840s and in the 1860s and 70s, knew that mankind must transform nature in order to safeguard his existence and he expounded this view several times;[319] but something else follows from this too.

Marx does not suggest that all that communism can bring about is a significant reduction in labour time. We are led astray if we would equate the reduction of working time with a reduction of the realm of necessity, as many authors seem to do. When Marx speaks about "development of human energy which is an end in itself" (Capital 3:820), this refers to his earlier treatment of the problem of how human wealth can be conceived. Take, for example, the following passage from the German Ideology where Marx draws some attention to the definition of spiritual wealth and praises the establishment of the world market as an important element in this respect: "From the above it is clear that the real intellectual wealth of the individual depends entirely on the

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319 Marx, the aristotelian, conceives of the realm of necessity and the realm of freedom both in a similar and in a different way from Aristotle. They are similar in stressing the natural necessity of labour as a life-maintaining process; they are different in that Marx does not locate labour in the realm of oikos, the private household, to which in Aristotle the nobler politeia, the public, corresponds. Marx introduces labour into the public sphere, attributing to it "noble" characteristics and locating an emancipatory dimension in it.

wealth of his real connections. Only this will liberate the separate individuals from the various national and local barriers, bring them into practical connection with the production (including intellectual production) of the whole world and make it possible for them to acquire the capacity to enjoy this all-sided production of the whole earth (the creations of man)." (CW 5:51). In the Grundrisse, he returns to this problem, citing a view which sees in the establishment of impersonal relations an advantage: "It has been said and may be said that this is precisely the beauty and greatness of it [the world market]: this spontaneous interconnection ... which is independent of the knowing and willing of the individuals, and which presupposes their reciprocal independence and indifference. And, certainly, this objective connection is preferable to the lack of any connection, or to a merely local connection resting on blood ties, or on primeval, natural or master-servant relations." (Grundrisse 161-2). But at the same time he adds a critical judgement: "Equally certain is that individuals cannot gain mastery over their own social interconnections before they have created them. But it is an insipid notion to conceive of this merely objective bond as a spontaneous, natural attribute inherent in individuals and inseparable from their nature (in antithesis to their knowing and willing). This bond is their product. It is a historic product. It belongs to a specific phase of their development. The alien and independent character in which it presently exists vis-a-vis individuals proves only that the latter are still engaged in the creation of the conditions of their social life, and that they have not yet begun, on the basis of these conditions, to live it." (Grundrisse:162).

I return in 5.5. to the Vico argument contained in this passage. What is of interest here, is that the world market is a condition for the development of human wealth. Communism will not abolish

the world market, but bring it under the conscious control of the producers. Consider now again the passage from the Grundrisse which has been cited in chapter 4.5. and which defines "real wealth":

> "In fact, however, when the limited bourgeois form is stripped away, what is wealth other than the universality of individual needs, capacities, pleasures, productive forces, etc., created through universal exchange? The full development of human mastery over the forces of nature, those of so-called nature as well as of humanity's own nature? The absolute working-out of his creative potentialities, with no presupposition other than the previous historic development, which makes this totality of developmenti.e. the development of all human powers as such the end in itself, not as measured on a predetermined yardstick? Where he does not reproduce himself in one specificity, but produces his totality? Strives not to remain something he has become, but is in the absolute movement of becoming?" (Grundrisse:488).

I take this eloquent list of rhetorical questions as an extended version of the short remark in Capital 3, where Marx speaks of the development of human energy as end in itself. From the above passage it is clear that the development of human powers depends (1) on a given stage of transformation of nature; (2) on human capacities which have already been reached; (3) on new capacities which emerge and on human needs which set in motion the drive for new goals. Or, in the language of Capital 3, "the true realm of freedom, ... however, can blossom forth only with this realm of necessity as its basis." (Capital 3:820) But it follows equally, and this is the stress in Capital 3, that mankind for this reason will always have to work. Only a stationary society would allow for the reduction of labour time to an insignificant length. However, Marx leaves no place for a "stationary state" of society which would have been for him a society restricting human freedom

in an unacceptable way. The development of human powers demands the production and reproduction of the conditions necessary for it. The shortening of the working day is the prerequisite for this "development of human energy as an end in itself", as Marx claims in Capital 3. In order to further defend my position that Marx was not content with a simple reduction of working time in communist society, I give two possible readings of this sentence. First, it can be argued that the above claim refers above all to capitalist conditions where labour indeed has an alienated character. The shortening of the working day is a condition for the producers to be able to develop new creative powers and new needs. The working time, the work-load and the alienated character of labour under capitalism fetters such a development. Therefore, the working day has to be shortened. But if, in a communist society, labour has lost its alienated character, if humans develop their creative potential also in and through the process of production, there may be less importance of shortening the working day. Imagine people who already in capitalist society are among the happy few to perform above all creative labour. Many of them would consider a limitation of the working time as restriction of their personal needs and creativity. In a communist society, according to Marx, surplus labour itself will become a need (see Grundrisse, Berlin: 231).

Second, in a passage in the Manuscripts 1861-63, Marx defines free time in the following way:

> "Indem Arbeitszeit frei wird - und die Mehrarbeit schafft nicht nur freie Zeit, sie macht Arbeitsvermögen, das in einem Productionszweig gebunden war, Arbeit überhaupt frei (dieß ist der Punkt) für neue Produktionszweige. Es liegt aber in dem Entwicklungsgesetz der menschlichen Natur, daß sobald für die Befriedigung eines Kreises der Bedürfnisse gesorgt ist, neue Bedürfnisse frei werden, geschaffen werden. Indem das Capital daher die Arbeits-

> zeit über das zur Befriedigung der Naturbedürftigkeit des Arbeiters bestimmte Maaß hinaustreibt, treibt es zu größerer Theilung der gesellschaftlichen Arbeit... und damit der Bethätigung der menschlichen Anlagen in neuen Richtungen." (MEGA II.3.1.:175).

Elster thinks that it is a "vexed issue whether Marx believed that in communism man would realize himself in work or outside of it" (Elster 1985:84) and suggests three possible readings of the texts. The first is that work will become life's prime want, the second is that work will become superfluous and the third that man will realize himself outside work. As textual evidence, Elster cites a passage from the Grundrisse ("he steps to the side of the production process", Grundrisse:705) to support the second reading, and the above quoted passage from Capital 3 to support the third reading. However, as follows from my discussion, I propose to dismiss the second and the third reading, retaining only the first.[320]

I now turn to another misinterpretation of the passage which is in issue. Some authors have interpreted it as if it would contain the possibility of a leap from the realm of necessity into the realm of freedom. Engels, in his Anti-Dühring, coined the term of "humanity's leap from the realm of necessity into the realm of freedom". He argued that with the seizing of the means of production by society, man becomes "master of his own social organisation." (CW 25:270). However, Engels' treatment of the matter is based on social aspects alone, as becomes even more clear in the

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320 That the Grundrisse do not intend to abolish labour tout court seems to be plain. Heller claims that labour is conceived as a vital need; the control of the production process presupposes highly-developed individuals.

following passage: "Man's own social organisation, hitherto confronting him as a necessity imposed by nature and history, now becomes the result of his own free action. The extraneous objective forces that have hiterto governed history pass under the control of man himself." (ibidem). But Marx, in the above passage, makes an argument about natural necessities. He says that human beings, in their development, will expand their wants thus creating a counter-tendency to a decreasing realm of necessity. There might be one possibility for such a leap: if we imagine a "stationary state" (James Stuart Mill) which is able to produce its wealth in an ever decreasing amount of time - if its population remains constant and no new needs are developing. This necessary transformation of nature could be done by means of an automated production process. But such a stationary state is completely incompatible with Marx's definition of what human freedom means. It is an integral part of his theory of human nature that humans develop, that they are creative and innovative, that they aquire new needs and knowledge and find new solutions to emerging problems.[321] In Capital 1, he writes:

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321 See the following passage from John Stuart Mill: "I cannot, therefore, regard the stationary state of capital and wealth with the unaffected aversion so generally manifested towards it by political economists of the old school. I am inclined to believe that it would be, on the whole, a very considerable improvement on our present condition. I confess I am not charmed with the ideal of life held out by those who think that the normal state of human beings is that of struggling to get on; that the trampling, crushing, elbowing, and treading on each other's heels, which form the existing type of social life, are the most desirable lot of human kind." (Mill 1909:748). While Marx could have agreed with the undesirable traits of industrial society, he certainly would not have agreed with the endorsement of the stationary state. See, also, Fetscher (1985).

> Only by suppressing the capitalist form of production could the length of the working-day be reduced to the necessary labour time. But, even in that case, the latter would extend its limits. On the one hand, because the notion of 'means of subsistence' would considerably expand, and the labourer would lay claim to an altogehter different standard of life. On the other hand, because a part of what is now surplus-labour, would then count as necessary labour..." (Capital 1:496).

The point is that Marx is talking about natural limits to the transformation of nature which stem from this peculiarly human condition. In other words: the social character of human beings re-establishes anew the natural limits at each stage of historical development. The "natural limits" are physically given and socially produced.[322] Since these natural limits do exist, no matter if physically given or socially produced, there is no place for speculation about mankind's "leap" into the realm of freedom, as the Marxist tradition has assumed. The standard Marxist interpretation holds that the realm of freedom will be based on material abundance., only with this will it be possible to overcome personal differences. The similarities of this reading with the following observation of Hume are obvious. In A Treatise of Human Nature, Hume pointed out that the conditions for justice derive from a specific situation in which mankind finds itself limited by selfishness and limited generosity of the human mind and scarcity of external objects (cf. Hume 1964, 266-7). However, among people imbued with mutua affection, things are often rendered common property, as "married people in particular lose their property and are unacquainted with the mine and thine... The same effect arises from any alteration in the circumstances of mankind, as when there is such a plenty of any thing as satisfies all the desires of

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322 See Hirsch (1976).

men.. In which case the distinction of property is entirely lost, and every thing remains in common." (Hume 1964, 267).

And:

> "(I)f men were supplied with every thing in the same abundance, or if every one had the same affection and tender regard for every one as for himself; justice and injustice would be equally unknown among mankind." (Hume 1964, 267)

Interestingly, Marx also uses part of this argument in the Critique of the Gotha Programme. Needless to say, he did not include the aspect of mutual affection, but the aspect of material abundance is clearly seen as the basis for the withering away of justice. This line of argument played a most important role in the aftermath of the Russian Revolution, where it was supposed to explain why a country like Russia with such little material wealth could not do away with the state bureaucracy, for example. Trotsky used this argument, saying that state and money would remain necessary as long as the material basis (i.e. more or less abundance) did not allow their withering away (Trotsky 1936:56 ff.). But one should not overestimate the passage from the Critique of the Gotha Programme, for Marx was aware that people were different, that even personal antagonisms might survive capitalism (cf. 1859 Preface) and thus the conditions of justice might not disappear in communism (see also 5.5.3.). But let us return to the interpretation of the quoted passage from Capital 3.

Most commentators share the opinion that Marx's position as expressed in the above passage was essentially pessimistic (in comparison with the early writings, and, of course, in comparison with the Grundrisse), or anti-utopian (cf. Cohen 1978:323). In what follows I shall discuss these claims.

In commenting on the above passage from Capital 3, G.A. Cohen writes: "On this account, freedom inside socialist industry is regrettably limited, and Marx looks for what he calls true freedom beyond the economic zone. His idea is ... that labour ... being a means of life, ... cannot be wanted [but] will be replaced by desired activity as the working day contracts." (Cohen 1978:324). I think that this is a wrong interpretation. Cohen seems to interpret this passage as if it dealt with the same problems which Marx discussed in the Grundrisse and where he tried to combine labour and enjoyment. But the above passage is simply not about this question. The stress in Capital 3 lies on the question of how far a socially liberated ("emancipated") society can emancipate itself from eternal natural necessities even where labour has been transformed into "travail attractif". Marx does think of an introduction of freedom into the realm of necessity, although put in a rather negative way: "freedom in this field can only consist in..." Marx surely thinks that the realm of necessity can be regulated by human beings in a non-alienated way, in a manner which is "worthy of their human nature". But Marx makes it clear that all activity in this field is determined by nature, and for this reason he calls it the realm of necessity. The notion refers to the transhistorical Stoffwechsel between man and nature, which is expressed in the phrase "just as the savage must wrestle..." Cohen's confusion comes out most clearly in his comment on this natural necessity. He writes: "Granted, there will always be a set of operations on whose completion the provisioning of the race depends. But it does not follow, and it is not equally undeniable, that there will always be tasks which men perform against their inclination because they have to." (Cohen 1978:324). Whereas the first sentence accepts the eternal necessity of transforming nature, the second introduces a somewhat obscure imputation to Marx, since Marx in the above passage nowhere speaks about personal "inclinations". It is a transhistorical, invariable

feature of mankind, that it has to transform nature, under all social arrangements and in all stages of its development with the exception of tribal pre-class communities which only appropriated the gifts of nature. It is an historically variable feature how this interchange with nature is organised; and it is a historical fact (Marx, moreover, certainly thought that it was historically inevitable) that this interchange has not yet been organized in a rational way, has not yet been brought under the common control of the (associated) producers. Quite the contrary: the producers are ruled by "it" (i.e. by the natural necessity of transforming nature and its results) as if it were a blind power. Marx, optimistically, thinks that a future society will be able to change this and he lists four criteria according to which it should be done: 1. socialized man, associated producers (as against egoistic individuals, only pursuing their individual interests), 2. rational control of the interchange with nature (as against being ruled by it as a blind force), 3. spending as little energy as possible during this interchange, 4. establishing conditions for this interchange which are most favourable and worthy of their human nature.[323] But, as Marx makes clear, this still remains a realm of necessity; not because labour has an unwanted character ("social duty" in Heller's words) in the sense that people are forced by others to work, but in the sense that they are forced by nature to work.

It may be useful to discuss, additionally, the interpretation of Agnes Heller here in order to make my intention clearer. She cites a passage from the Theories of Surplus Value which reads as follows: "But free time, disposable time, is wealth itself,

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323 The utopian strand of this outline is considerable, cf. only point 2: rational control. In its strong version, this claim would exclude unintended consequences from social life.

partly for the enjoyment of the product, partly for the free activity which - unlike labour - is not dominated by the pressure of an extraneous purpose which must be fulfilled, and the fulfillment of which is regarded as a natural necessity or a social duty, according to one's inclination." (TSV 3:257, cited in Heller 1976:105)[324] . She comments: "In the model which is outlined in Capital and in Theories of Surplus Value, production for needs is not correlated with labour as a vital need, but with labour as a 'social duty'. (Heller 1976:110)[325] .

But Heller fails to see that for Marx, too, that type of labour which is a vital need has at the same time the character of a natural necessity. This natural necessity is a social duty since society has to maintain its interchange with nature i.e. every social form has to establish rules according to which the interchange with nature is accomlished. As I said above (contra Cohen), even "travail attractif" belongs to the realm of necessity, since it is forced upon mankind by nature. Marx wants to stress that this extreme conclusion follows from the existential situation of mankind as a product of natural evolution

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324 The original reads as follows: "Aber free time, disposable time ist der Reichtum selbst - theils zum Genuß der Producte, theils zur free activity, die nicht wir die labour durch den Zwang eines äußeren Zwecks bestimmt ist, der erfüllt werden muß, dessen Erfüllung Naturnothwendigkeit oder sociale Pflicht, wie man will." (MEGA II.3.4.:1388)

325 Hannah Arendt (1958), in particular, stressed this duty character of work in Marx, thereby influencing a whole range of thinkers, among them Habermas. I rather agree with Honneth that this appraoch deprives the concept of labour its normative dimension; moreover, it is based only on the historical experience of modern industry, where a big percentage of wage labour has lost all of its emancipatory capacity (see Honneth 1982). Such a deprivation has no base in Marx at all.

which is dependent on nature. The growth of productive forces and the abolition of class rule can change nothing in this respect. But the abolition of class rule will lead to a different character of work in the production process, as Marx points out:

> Es versteht sich von selbst, daß die time of labour selbst, dadurch, daß sie auf normales Maß beschränkt, ferner nicht mehr für einen andren, sondern für mich selbst geschieht, zusammen mit der Aufhebung der socialen Gegegensätze zwischen master and men etc, als wirklich sociale Arbeit, endlich als Basis der disposable time einen ganz andern freiern Character erhält und daß die time of labour eines man, der zugleich der man of disposable time ist, viel höhere Qualität besitzen muß, als die des Arbeitsthiers. (MEGA II.3.4.: 1388, my emphasis)[326].

Whereas in capitalism workers are transformed into working animals ("Arbeitsthiere"), in communism the individual's labour assumes a free character. This view entails a) that labour is a vital need and b) that it can be done in a pleasant way.[327] When Heller juxtaposes labour as duty and labour as a vital need she fails to distinguish between two different forms of duty. But as I would maintain, one cannot understand Marx's position properly if one

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326 Avineri rightly pointed out that "[m]an can never emancipate himself from this basic existential need, but he can emancipate himself from the process that makes the satisfaction of these needs into a dehumanizing drudgery." (Avineri 1967:237).

327 It may cause some confusion that Marx equates "natural necessity" with "social duty" in the above passage, especially in the light of my insistence that we ought to distinguish between natural and social factors which shape man's existence. But there is no contradiction involved. Marx simply holds that if social relations ("social duties") appear as natural neccessities, we have a condition of fetishism i.e. social relations are naturalized which - for Marx - is a state "unworthy of human nature".

does not recognise that in the above passage, (Capital 3:820), two kinds of duty are involved. The first is a duty which is imposed upon individuals from nature and which Marx terms "natural necessity"; the second is a duty which is imposed upon individuals from other individuals, from one class upon another. Marx regards only the first duty as unchangeable; whereas the second, it goes without saying, caused his outrage. If we interpret Marx in this way, labour as "duty" and labour as "vital need" need not contradict each other: the duty imposed by nature can be fulfilled in a free and unalienated way. Cohen recognised this possibility when he made the analogy to another "natural duty": "Some eating is enjoyable" (Cohen 1978:324)[328].

Marx, discussing child labour, makes clear that he held productive activities indispensable even for children, in order to make them "full individuals". He clearly rejected all existing capitalist forms of child labour which only destroyed the childrens' talents and health;[329] but at the same time he insisted on the educative principle to combine theoretical with productive activities:

> A general prohibition of child labour is incompatible with the existence of large-scale indistry and hence an empty, pious wish. Its realisation - if it were possible - would be reactionary, since, with a strict regulation of the working time according to the different age groups and other safety measures for the protection of children, an early combination of productive labour with education is one of the most potent means for the transformation of present-day society." (SW 3:29)

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328 Ironically, Cohen intended this as an argument against Marx.

329 For another interpretation, see footnote 369.

This should make sufficiently clear that Marx had an emancipatory notion of labour also in his later works. But yet another problem arises with Heller's account. According to her, Marx "stresses that labour always remains the realm of necessity and that the realm of freedom 'begins' outside it (in free time)." (Heller 1976:110). This is obviously not true. As I have shown above, Marx does locate elements of freedom within the realm of necessity: he gives four criteria which need to be fulfilled. The fourth says that human beings should organize their production in a way most favourable and worthy of their human nature. This is in line with Marx's general position according to which labour and enjoyment ought, and can, go together.

An explicit claim that Marx belongs among the great pessimists in modern european thought is made by Alfred Schmidt. He rightly interprets the passage in Capital 3 as containing a question about the natural limits to human freedom. Schmidt thinks that mankind, on the one hand, transforms first nature to an ever greater degree into second nature with the result that nature gets humanised ("Einwanderung ins Subjekt", cf. Schmidt 1971:123). On the other hand, he maintains that the rock of nature will be eternally in opposition to mankind (see Schmidt 1971:162). This is nature's undissolvable rest which will never be transformed.[330] Schmidt's argument is obviously shaped in contrast to Ernst Bloch's nature speculation, in contrast to his hope for a reconcilation of mankind with nature to which I shall turn in a moment. Before discussing Bloch's position (and Schmidt's critique of it), we shall first look at Habermas' analysis of the relation between first and second nature.

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330 However, a bit problematic is that Schmidt imputes Freud's Triebverzicht to Marx, see Schmidt (1971:140-3).

5.3. Habermas: Marx between Kant, Fichte and Hegel

Habermas, like Schmidt, emphasises the double influence of Kant and Hegel on Marx's concept of nature. The knowledge that first nature cannot be completely transformed into second nature thwarts the Hegelian component in Marx's model. Instead, argues Habermas, something like the Kantian Ding an sich re-emerges here.

> "The materialist concept of synthesis [through social labour] thus retains from Kant the fixed framework within which the subject forms a substance that it encounters. This framework is established once and for all through the equipment of transcendental consciousness or of the human species as a species of tool-making animals. On the other hand, in distinction from Kant, Marx assumes empirically mediated rules of synthesis that are objectified as productive forces and historically transform the subjects' relation to their natural environment." (Habermas 1971a:35).

Habermas holds that Marx tried to overcome this theoretical dilemma by means of Fichte's philosophy. In so doing, Marx limits Fichte's absolute ego to mankind, which is a product of natural evolution and at each stage in its history is determined by the productive forces available to it. This can be stated in Fichte's terms where ego confronts its non-ego: "This interpretation given by Fichte with stubborn logic to Kant's pure apperception sheds light on the identity of socially laboring subjects as it is conceived by materialism. As an identical ego they find themselves confronting an environment that obtains its identity in labor processes; this environment is not ego." (Habermas 1971a:39) Habermas rightly emphasises that Marx is congenial to Fichte's insistence (against Kant) that the unity of consciousness is achieved only by an act of self-consciousness: it is a product of activity (cf. Habermas 1971a:40). Marx's stress on the active

element in man's relationship to nature here, parallels his judgement of Feuerbach. Having appreciated Feuerbach's philosophy in the early 1840s, Marx in 1845 reassures himself of the importance of the active element, which was developed by idealism. As he wrote in the first Thesis on Feuerbach: "The chief defect of all previous materialism (that of Feuerbach included) is that things [Gegenstand], reality, sensuousness are conceived only in the form of the object, or of contemplation, but not as sensuous human activity, practice, not subjectively. Hence, in contradistinction to materialism, the active side was set forth abstractly by idealism - which, of course, does not know real, sensuous activity as such." (CW 5:2) Marx restates with Fichte Hegel's critique on Kant without sharing Hegel's identity philosophy:

> "Marx restricts Fichte's absolute ego to the contingent human species. Its act of self-generation, the activity in which it constitutes itself, is thus absolute only in relation to historical formations of the ego and the non-ego, to societal subjects and their material environment. Production is conditioned on both sides by 'natural presuppositions' [nature and human labour, R.G.]" (Habermas 1971a:40).

But, Habermas continues, Marx's approach does not allow for a critical self-reflection of the productive subject, because Marx limits production or praxis to labour (see Habermas (1971a:42). Habermas claims that there is a discrepancy between Marx's social theory and his philosophical self-understanding. In his social theory he was aware of both instrumental and communicative action, where the first consists of transforming nature, the second is emebedded in cultural traditions and is exercised via symbolically mediated interaction. However, so goes Habermas' charge, Marx did not translate this insight into his philosophical framework. "Taken by itself, scientific-technical progress does not yet lead to a reflexive comprehension of the traditional, 'natural'

operation of the social life process in such a way that self-conscious control could result..." (Habermas 1971a:51).

5.3.1. Labour and Interaction

Habermas' theoretical interest is thus in the first place to provide some thoughts on the philosophical-epistemological level. He does not think that Marx's concept of labour can fulfil this task. Instead, he introduces a distinction between two types of action: instrumental, nature-transforming action (which is characterised by means-ends-relationships) on the one hand, and communicative action on the other.[331] He characterises the first type of action as typical of social systems, the second as typical of the life-world.[332] I doubt that this distinction can help us tackle the ecological problematic. One reason for my scepticism is this: even granted that the institutional conditions for human emancipation do exist, there might still be something which escapes Habermas' framework but which is contained in that of Marx, above all in his analysis of machinery in the Grundrisse and the Manuscripts (1861-3). In other words, Habermas suggests that we could separate a conscious control of social life-production from the process of material production: "Marx very precisely distinguishes the self-conscious control of the social life process by the combined producers from an automatic regulation of the process of production that has become independent of these individuals. In the

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331 Thereby taking up the distinction made by Aristotle (and further developed by Hannah Arendt) between praxis and poiesis.

332 Instrumental action therefore not only refers to the transformation of nature, but also to the operation of social systems.

former case the workers relate to each other as combining with each other of their own accord. In the latter they are merely combined..." (Habermas 1971a:51).

But this "automatic regulation of the process of production" may constrain the "self-conscious control" for ever. Communism in the strong sense ("human society") would thus be impossible. Habermas himself is aware that the development of productive forces leads to an increasing embodiment of knowledge in machines (Habermas 1971a:55 ("auf die Ebene von Maschinen abgebildet wird", Habermas 1968:76) which has its limiting value in the "organisation of society itself as an automaton" (Habermas 1971a:55). But if this is true, then Habermas' distinction between instrumental and communicative action becomes less important. For what can the "self-reflection" (which is embedded in the latter type of action) achieve? According to Habermas, it can achive abolition of ideological delusion (Verblendung) and class rule. But perhaps a still more urgent problem has been thereby neglected: the existence of a productive automaton which remains even after the fall of bourgeois order as an "animated monster". Communism could only mean the establishment of a classless society which is, however, still a society in which "superior powers" are generated and reproduced systematically. Habermas does not seem to realise that Marx's "ingenious combination of Kant and Fichte" (Habermas 1971a:55) is not doomed to fail because his model offers no place for critical self-reflection, but that on Marx's own account we have to reckon with the possibility that first nature can be transformed into second nature (under industrial conditions) only by paying the price of technological alienation. In other words, growth in productive forces leads to an increase in artefacts, vis-a-vis which the producers are only "combined", not combining. As Marx noted in the Grundrisse:

> "The combination of this labour appears just as subservient to and led by an alien will and

> an alien intelligence - having its animating unity elsewhere - as its material unity appears subordinate to the objective unity of the machinery, of fixed capital, which, as animated monster, objectifies the scientific idea, and is in fact the coordinator, does not in any way relate to the individual worker as his instrument; but rather he himself exists as an animated individual punctation mark, as its living isolated accessory." (Grundrisse: 470)[333].

Now, if this trend cannot be reversed under communism, the "true human society" will remain utopia for ever. Habermas, although citing the same passage, does not pay attention to this problem. He remains blind to the problem which technology poses to modern societies, since he thinks that technology can neither be brought back into the life-world of the individuals nor that another type of technology can be imagined. He seems to assume that in order to make the producers the beneficiaries of a growth in productive forces,[334] the establishing of a society in which the ideal speech situation is institutionalised would be necessary and sufficient. My argument against this is that not even such a society would have the means for controlling the unbounded "animated monster". As before, the producers would be the combined and not the combining. When they are stepping aside the production process and engaging in discursive activities, they will eventually realise that their way of transforming nature must be changed; and is precisely here that Habermas' model does not show how the two can be brought

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333 As I have shown in chapter 3, Marx's final analysis in Capital differs from this outline.

334 Habermas rightly sees that growth in productive forces and the conditions of the good life are not identical, the former can "at best serve" the latter, cf. Habermas (1971b: 119).

together, unless he can show how the communicative action influences the instrumental one.[335]

There is a certain ambivalence in Habermas (with respect to technical progress) which comes out in his "early" critique of Marcuse. Here Habermas seems to immunize technical development against criticism: "The idea of a New Science will not stand up to logical scrutiny any more than that of a New Technology... For this function, as for scientific-technical progress in general, there is no more 'humane substitute'." (Habermas 1971b:88). But here Habermas confuses technical and scientific development, partly identifying science with technology.[336] To avoid a possible misunderstanding here, I should say that I agree that in industrially developed societies there can be no functional alternatives to science and technology; but there can be other technologies (whilst it is difficult to imagine another science).[337]

Habermas presents a somewhat different approach in the article "Technology and Science as Ideology" which was written three years earlier. Here Habermas acknowledges that "this thesis of the autonomous character of technical development is not correct." (Habermas 1971a:59). He rightly sees that "the pace and the direction of

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335 Given his distinction between system and life-world, we have the possibility for citizens' protest against exaggerated claims from the system ("Übergreifen systemischer Imperative auf die Lebenswelt").

336 The reason for this is his immaterial definition of productive forces, see chapter 4.

337 This is the result of my analysis of social systems in chapter 3 and 4, where I argued that technology is no social system. It follows that technology is open to social determination, its autonomy only an apparant one. The concrete shape of existing technologies is the result of conflicts and negotiations between social systems.

technical development today depend to a great extent on public investments." (Habermas 1971a:59). Moreover, he says that technology is coupled with economy, science and politics (cf. id.) But even on the basis of this approach he stops short of considering the topic of changing existing technologies when he writes that "through the unplanned sociocultural consequences of technological progress, the human species has challenged itself to learn not merely to affect its social destiny, but to control it." (Habermas 1971a:61) This is to say "the social potential constituted by technical knowledge and ability [is brought] into a defined and controlled relation to our practical knowledge and will." (Habermas 1971a:61) He sees the main obstacle to this in social interests that arise naturally [naturwüchsig]out of the compulsion of the reproduction of social life without being reflected upon and confronted with the declared political self-understanding of social groups." (Habermas 1971a:60, amended translation[338]) This is definitely not a mere restating of the orthodox Marxist position that it is only captalist class rule which needs to be abolished; even a "classless" industrial society would probably (to a certain extent) face these problems. But Habermas fails to show how the communicative type of action can change the course of technological development since here he thinks that it should be changed. Habermas himself poses the question in the following way: "[H]ow can the relatiom between technical progress and the social life-world, which today is still organized in a natural way, be reflected upon and brought under the control of rational discussion?" (Habermas 1971a:53, amended translation). Habermas's answer points to the liberating potential of an undistorted political discussion. Such a discussion is prohibited by domination (Herrschaft), by interests which are not

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338 I use the term "natural" to render the German "naturwüchsig", as is done throughout this work.

subject to public justification (cf. Habermas 1971a:61). I doubt that such a diagnosis and therapy is sufficient for the problem at stake. Habermas's somewhat imprecise use of the notion of "domination" is obscuring rather than illuminating here. For what is meant by this notion? Obviously it is to denote the interests of social systems vis-a-vis the life-world, or, as he later says, the spill-over of systemic imperatives to the life-world. However, these social systems operate according to different systems-codes; I find it difficult to fuse them together under the general heading "Herrschaft". I would maintain that it is more illuminating to investigate the different mechanisms of the sub-systems of society (i.e. also their conflicts!) in order to bring out both the dangers of some modern technologies and the possibilities to solve them.[339]

To summarise: Habermas' framework seems to imply too rigid a distinction between different types of action, such that the communicative element is excluded from nature-transforming activities. Ironically, he himself has to reintroduce the communicative element to enable social reflexivity. This reintroduction is necessary for Habermas, since he is aware that a liberated society has not only to become self-reflexive in its communicative sphere, but also in its technical-instrumental sphere. But is, then, the separation between instrumental and communicative action of great help for the understanding of ecological problems?

5.4. Messianic Marxism

339 For an attempt to do so, see Luhmann (1986).

In this section, I set out to examine two writers who present an extraordinarily unorthodox Marxism: Ernst Bloch and Walter Benjamin. Both writers are most interesting in that they focused on the problem of modern societies' relationship with nature already some 40 years ago. I shall claim that they are able to arrive at a position which is peculiarly aware of ecological problems on the basis of their metaphysical orientation.

5.4.1. Ernst Bloch: Marxism of technology

It is a merit of Bloch's analysis that he addresses the problem of science and technology for communist society in a detailed way. In his book Das Prinzip Hoffnung, written during World War II and published in the 1950s, he discusses the question of technology above all in the chapter "Wille und Natur, Die technischen Utopien". He praises bourgeois technology for having achieved some degree of progress, especially in constructing what he calls "de-organicist" technology (entorganisierte Technik). This term is to denote the fact that modern technology cannot be understood any longer as a simple extension or replacement of the body (tool-arm; saw-teeth; eye-lens; etc.) but must be conceived as something completely new: "Und je mehr Technik die letzten Reste ihrer alten Bodenständigkeit verliert, ... in synthetischer Rohstofferzeugung, in Strahlungsindustrie und was noch sonst in herrlicher Hybris: desto intimer wie zentraler muß die Vermittlung mit dem eigeschalteten Naturwesen geraten." (Bloch 1959:784, 814). This "de-organicist" technology enables a more intimate mediation with nature.

But at the same time, he charges bourgeois technology with being too abstract, of pressing forms onto natural contents without understanding them: "Unsere bisherige Technik steht in der Natur wie eine Besatzungstruppe in Feindesland, und vom Landesinnern weiß

sie nichts, die Materie der Sache ist ihr transzendent." (Bloch 1959:814)[340] . In this respect, bourgeois technology is similar to capitalist economy: both produce accidents. Nevertheless, bourgeois technology is more reliable than its economy: "Gewiß ist die bürgerliche Technik kraft ihrer Wahlverwandtschaft mit natürlichen Mechanismen bedeutend solider als die kapitalistische Wirtschaft, auch nicht-euklidische Kühnheiten sind ihr nicht versagt, sie zeichnen sich, wie zu sehen war, bemerkenswert ab." (Bloch 1959:812). Bloch aims at a more intimate transformation of nature following Bacon: "Die Naturbeherrschung ... dient bei Bacon der Aufrichtung eines 'regnum hominis'... Bacons großer Grundsatz: 'natura parendo vincitur' ... blieb lebendig, doch er wurde durch das Interesse einer 'Ausbeutung' der Natur durchkreuzt, durch ein Interesse also, das mit der natura naturans, die Bacon noch kennt und als 'causa causarum' auszeichnet, nichts mehr zu tun hat, geschweige daß es mit ihr verbündet wäre." (Bloch 1959:766-7).

Against this Bloch holds that we have to construct new technologies which achieve a more intimate relationship with nature; a relationship which is totally different from the attitude of a conquerer who stands in the land of the enemy, pushing around the recalcitrant elements. Bloch accepts that it is mankind's project to gain fuller mastery over nature. However, he does not agree that "exploitation of nature" should be part of that project.

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340 The metaphor of the conqueror was also used by Engels - see CW 25:461. Interestingly, Engels says the following with respect to the Italian Alps: "When the Italians of the Alps used up the pine forests on the southern slopes, so carefully cherished on the northern slopes, they had no inkling that by doing so they were cutting at the roots of the dairy industry in their region: they had still less inkling that they were depriving their mountain springs of water for the greater part of the year and making it possible for them to pour still more furious torrents on the plains during the rainy seasons." (CW 25:461).

There are two terminological questions which arise here. The first is the question whether nature can be exploited, if it makes sense to speak of an "exploitation of nature" in the strict sense.[341] When talking about exploitation, we usually have individuals in mind who, according to some moral standards, can be said to exploit other individuals. Obviously, this does not apply to man's relationship to nature, unless one is prepared to adopt an approach which attributes rights to nature (see the discussion in chapter 2). In a weaker sense, however, we all speak of exploitation of natural resources, a process which Bloch does not oppose as such. "Marxismus der Technik, wenn er einmal durchdacht sein wird, ist keine Philantropie für mißhandelte Metalle, wohl aber das Ende der naiven Übertragung des Ausbeuter- und Tierbändigerstandpunkts auf die Natur." (Bloch 1959:813) The second, and more important, question seems to be that Bloch uses the term also in another sense: he wants to express the fact that people will not succeed in mastering nature if they "exploit" it i.e. if they are not able to transform it according to some inherent laws or structures of the material elements. This means that they will not succeed in transforming it if they do not urderstand the laws and mechanisms involved.[342]

Bloch's position is thus a position within modernity, accepting central claims of Enlightenment Philosophy. He shares the belief that mankind can prosper in transforming nature; he does not reject the development of science and technology; on the contrary,

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341 Note that Bloch himself put "exploitation" in quotation marks.

342 As Bodei aptly pointed out, ancient thought conceived of technical solutions as solutions directed against nature; it was only with modern writers that they were understood as in accordance with natural laws - see Bodei (1983).

he holds that only more developed technologies will contribute to mankind's prospering. These new technologies, however, need to be based on more profound insights into nature - something which seems inhibited by present capitalist relations. In so doing, he implicitly tries to defend the 1859 Preface, although it is not clear if he charges capitalism with insufficient development or insufficient use of new productive forces.[343] But at the same time, Bloch is aware that not every increase in productive forces contributes to social progress when he says that all rejoice about great technical progress is in vain if it forgets that technical progress can be accompanied by social regress (cp. Bloch 1959:814).

My interpretation of Bloch is very charitable compared with that of Alfred Schmidt, for example. Let me therefore briefly sum up the criticisms of Schmidt. He charges Bloch (1) with overestimating the possibility of unifying subject and object. Bloch aims at a "mystical nature-subject" (Natursubjekt) which has not yet[344] revealed itself; (2) with being obscure about the "openness" [Unabheschlossenheit] and "latency" of nature. I address the two points in turn.

(1) Schmidt is right when he insists that mankind's purposes will always remain alien to nature - also in socialism (cf. Schmidt 1971:167) and that mankind has to outwit nature. In this respect Bloch's terminology is indeed misleading (or self-contradictory). Consider the following passage by Bloch: "An Stelle des Technikers

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343 See Elster (1985:259) for a distinction.

344 This is the crucial notion for Bloch: the "not-yet-character" of all exsting.

als bloßem Überlisters oder Ausbeuters steht konkret das gesellschaftlich mit sich selbst vermittelte Subjekt, das sich mit dem Problem des Natursubjekts wachsend vermittelt." (Bloch 1959:787). This may sound strange and confused, but one may interpret it that Bloch wants to stress the possible role of nature as co-producer, a role which can be set forth only on the basis of a deeper understanding of nature. But then, to repeat, he gets self-contradictory, since also the Baconian approach implies an "Überlister"-technology. Moreover, also the cooperative role of nature would put man in the role of exploiter or Überlister: either humans appropriate what nature freely produces, or they combine natural processes in a way beneficial to them: in the latter case, the "cunning of reason" (=überlisten) is at work. Of course, I agree that there are mystical and religious elements in Bloch's concept of nature; but, nevertheless, I think that the interpretation which I gave above is a legitimate one. To put it in another way, Bloch's metaphysical beliefs may have made him sensitive to a problem which does not interest so much traditional Marxists. We could say, then, that Bloch's analysis was non-Marxist in its motivation but Marxist in its method. It is admitted that there is a "metaphysical surplus" which does not square with Marxian thought (see also Hudson 1982).

(2) Schmidt's doubts about nature's "latency" seem to be even less justified. Here it is Bloch, rather, who is in greater accordance with the natural sciences. As we know from Darwinism, nature is an essentially unfinished and open process. Curiously, Schmidt thinks that higher beings than humans cannot emerge (cf. Schmidt 1971: 167). This seems to me an exaggerated amthropocentrism, one which conceives mankind as the centre of the universe. Evolution is a blind, and thus open process, the stages of which are not predetermined.

5.4.2. Walter Benjamin: the Resurrection of Past Generations

In chapters 3 and 4, I presented and discussed some evolutionary approaches to social history. It was argued that, on a materialist conception, the new can only emerge as a recombination of the existing. Such a view certainly may be challenged from several positions. One of them is a position which expects the new as the totally different from the present. Walter Benjamin, in his "Geschichtsphilosophische Thesen", put forward such an argument.

Criticising the notion of progress held by the German Social Democratic party, he noted that this was problematic in that it conceived of progress as (a) progress of the human species, (b) as unlimited (perfectability) and (c) as inevitable (cf. Benjamin 1974:700).[345] But basic to these three problematic notions is a concept of time as empty and homogenous.[346] Against such a concept Benjamin contends that history is a construction which is located in our time, not in empty and homogenous time: "Die Geschichte ist Gegenstand einer Konstruktion, deren Ort nicht die homogene und leere Zeit sondern die von Jetztzeit erfüllte bildet." (Benjamin 1974:701) This fact allows us to cite past events, just like fashion cites past clothes; the French revolution cited ancient Rome and understood itself as a renewal of it.

> "The French revolution viewed itself as Rome reincarnate. It evoked ancient Rome the way fashion evokes costumes of the past. Fashion has a flair for the topical, no matter where it stirs in the thickets of long ago; its a tiger's leap into the past. This jump,

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345 Note that his charge does not fit an evolutionary approach, as presented in chapters 3 and 4.

346 Lukacs in his seminal Geschichte und Klassenbewußtsein (1923) noted that modern capitalism transforms time into a pure quantitative category - see Lukacs (1971:179-80).

> however, takes place in an arena where the ruling class gives the commands. The same leap in the open air of history is the dialectical one, which is how Marx understood the revolution." (Benjamin 1973:263)

Central to Bejamin's argument is the notion of "blasting out" (herausspreng̲en) these past events from the continuum of history. This metaphor corresponds to a second one which refers to the picture we have of these past events and which is available to us only in moments of danger. Benjamin coins the term "flashing" (aufblitzen) for it: "Nur als Bild, das auf Nimmerwiedersehen im Augenblick seiner Erkennbarkeit eben aufblitzt, ist die Vergangenheit festzuhalten." (1974:695)[347]. With these two basic concepts, we can understand Benjamin's different conception of social change. There is no stream of progress in which the Social Democratic Party and the working class can swim, but there are unique historical opportunities where a picture becomes available to the historical subject which can be reactivated in such moments. "Dem historischen Materialismus geht es darum, ein Bild der Vergangenheit festzuhalten, wie es sich im Augenblick der Gefahr dem historischen Subjekt unversehens einstellt." (ibidem). This last technique refers to the method of the materialist historian; for the fighting class the cognitive flashing is combined with practical blasting out ("herausspreng̲en").[348] Benjamin's preoccupation with the phlegmatic politics of the Social Democrats leads to an overreaction. He frankly endorses an extreme subjectivism: for him, there seem to be no historical laws or mechanisms but only the one of the grasping of unique

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347 "The past can be seized only as an image which flashes up at the instant when it can be recognised and never seen again." (Benjamin 1973:257).

348 Note that both metaphors are metaphors from war; Benjamin wrote this text in 1942.

historical opportunities. This "tiger's jump" into the past corresponds to his claim of an increasing acceleration of history, as he noted in Thesis XVIII:

> "'In relation to the history of organic life on earth' writes a modern biologist, 'the paltry fifty millennia of homo sapiens constitute something like two seconds at the close of a twenty-four-hour day. On this scale, the history of civilized mankind would fill one-fifth of the last second of the last hour.' The present, which, as a model of Messianic time, comprises the entire history of mankind in an enormous abridgement, coincides exactly with the stature which the history of mankind has in the universe." (1971:265)

Although Benjamin calls this approach the true approach of the historical materialist, it is, rather, idealist. The "totally different" is not something which has not yet been there, but, rather, something which has indeed existed a long time ago. Proletarian revolution therefore consists in bringing back a lost state of history. Revolution, for Benjamin, is redemption, revenge for the injustice to former generations.

> Not man or men but the struggling, oppressed class itself is the depository of historical knowledge. In Marx it appears as the enslaved class, as the avenger that completes the task of liberation in the name of generations of the downtrodden. This conviction ... has always been objectionable to Social Democrats ... Social Democracy thought fit to assign to the working class the role of the redeemer of future generations, in this way cutting the sinews of its greatest strength. This training made the working class forget both its hatred and its spirit of sacrifice, for both are nourished by the image of enslaved ancestors rather than that of liberated grandchildren." (Benjamin 1971:262).

Although Benjamin is not concerned with future generations,[349] he is able to work out a sensitive position in relation to nature. However, this sensibility comes from his religious background. As he noted in Einbahnstraße, human beings have to revere nature, since they depend on nature and are not able to give it anything. Thus, whenever they receive something from nature, they ought to be grateful.

> "Aus den ältesten Gebräuchen der Völker scheint es wie eine Warnung an uns zu ergehen, im Entgegennehmen dessen, was wir von der Natur so reich empfangen, uns vor der Geste der Habgier zu hüten. Denn wir vermögen nichts der Muttererde aus Eigenem zu schenken. Daher gebührt es sich, Ehrfurcht im Nehmen zu zeigen, indem vor allem, was wir je und je empfangen, wir einen Teil an sie zurückgeben, noch ehe wir des Unsren uns bemächtigen... Nach athenischem Brauch war das Auflesen der Brosamen bei der Mahlzeit untersagt, weil sie den Herren gehören." (Benjamin 1972:101).

A society which greedily robs nature's treasures will suffer in the long run: "Ist einmal die Gesellschaft unter Not und Gier soweit entartet, daß sie die Gaben der Natur nur noch raubend empfangen kann, daß sie die Früchte, um sie günstig auf den Markt zu bringen, unreif abreißt und jede Schüssel, um nur satt zu werden, leeren muß, so wird ihre Erde verarmen und das Land schlechte Ernten bringen." (Benjamin 1972:101) According to

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349 In Annex B to the Theses, Benjamin makes clear that his approach is informed by Jewish religion: "We know that the Jews were prohibited from investigating the future. The Torah and the prayers instruct them in remembrance, however. This stripped the future of its magic, to which all those succumb who turn to the soothsayers for enlightenenment. This does not imply, however, that for the Jews the future turned into homogenous, empty time. For every second of time was the strait gate through which the Messiah might enter." (Benjamin 1971:266) But see Adorno (1977:619) for a view which mentions Benjamin's concern for future generations.

Benjamin, a society without exploitation might be able to give nature something back, even to "improve" it: "Hört diese [Ausbeutung, R.G.] auf, so wird die Arbeit ihrerseits den Character der Ausbeutung der Natur durch den Menschen abstreifen... Eine solche vom Spiel beseelte Arbeit ist nicht die Erzeugung von Werten sondern auf eine verbesserte Natur gerichtet." (Benjamin 1982:456, my emphasis)

Now, one might say that Benjamin's approach is forceful and persuasive but has the disadvantage as being based solely on an ethical dimension: gratitude towards nature.[350] Of course, he wants to abolish the social conditions which inhibit such an "alien" relationship to nature, but one might ask if this can be a realistic perspective for industrial societies. Let me thus turn to Benjamin's "technical utopia". Benjamin, unlike some "green" fundamentalists, does not reject technological development. When proposing Fourier's ideal of labour (i.e. play), Benjamin is aware that labour can become play only on the basis of the most developed productive forces: "Die Entfaltung im Spiel setzt höchst entwickelte Produktivkräfte voraus, wie sie der Menschheit heute erst zur Verfügung stehen und im Gegensinn ihrer Möglichkeiten bereitgestellt werden: für den Ernstfall nämlich." (Benjamin 1982:456) Likewise, this "liberated labour" is to "improve" nature by technical means. Benjamin again cites with approval Fourier's

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350 Interestingly, Bloch (1959:782) juxtaposes Schiller's and Goethe's concept of nature; according to Bloch, the former wants to dominate nature ("wohltätig ist des Feuers Macht, wenn sie der Mensch bezähmt, bewacht"), the latter is grateful to nature:

"Erhabener Geist, du gabst mir alles,
worum ich bat. Du hast mir nicht umsonst
Dein Angesicht im Feuer zugewendet.
Gabst mir die Natur zum Königreich,
Kraft, sie zu fühlen, zu genießen."

Phalanstères: "Nach Fourier sollte die wohlbeschaffene gesellschaftliche Arbeit zur Folge haben, daß vier Monde die irdische Nacht erleuchteten, daß das Eis sich von den Polen zurückziehen, daß das Meerwasser nicht mehr salzig schmecke und die Raubtiere in den Dienst des Menschen träten. Das alles illustriert eine Arbeit, die, weit entfernt die Natur auszubeuten, von den Schöpfungen sie zu entbinden imstande ist, die als mögliche in ihrem Schoße schlummern." (Benjamin 1974:699)[351]. Perhaps it should be said that nowadays we may have the possibility of creating such animals with the help of genetic engineering (not on the basis of liberated work): but who would be delighted? Similarly, the poles may be melting in the near future, but with quite disastrous consequences.

Furthermore, Benjamin hopes that mankind will make true cosmic experiences - which he thinks indispensable - with the help of technology. The ancient relationship towards the cosmos was mediated by the experience of ecstasy (Rausch), while we moderns have technical possibilities at hand. These possibilities are extrapolated from war-technologies which, of course, have been used only for destructive purposes. The result was a "river of blood" (cf. Benjamin 1972:147). But at the same time Benjamin is fascinated by these new technologies: "Hochfrequenzströme durchfuhren die Landschaft, neue Gestirne gingen am Himmel auf,

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351 Note the similarity with Bloch who uses the notion of nature's co-productivity, its "latency". See also the similarity to Bloch's technological utopia: "Wie die Kettenreaktionen auf der Sonne uns Wärme, Licht und Leben bringen, so schafft die Atomenergie... aus Wüste Fruchtland, aus Eis Frühling. Einige hundert Pfund Uranium und Thorium würden ausreichen, die Sahara und die Wüste Gobi verschwinden zu lassen, Sibirien und Nordkanada, Grönland und die Antarktis zur Rivera zu verwandeln." (Bloch 1959:775).

Luftraum und Meerstiefen brausten von Propellern..." (ibidem)[352] However, the fascination is immediately withdrawn when Benjamin adds the following to his enumeration: "...und allenthalben grub man Opferschächte in die Muttererde" (ibidem). The ruling class's yearning for profit had changed the bride's bed into a river of blood (cf. ibidem). This sexual metaphor can be seen to conceive of the possibilities of technology in the same way as Bloch: as in principle leading to a more intimate relationship with nature. Again, like Bloch, these possibilities are not put into practice as a result of capitalist relations.

Benjamin holds that the notion "domination of nature" is a suspect one. Who would trust a father, he asks, who beats up his children and declares the domination of children to be educational?

> "Naturbeherrschung, so lehren die Imperialisten, ist Sinn aller Technik. Wer möchte aber einem Prügelmeister trauen, der Beherrschung der Kinder durch die Erwachsenen für den Sinn der Erziehung erklären würde? Ist nicht Erziehung vor allem die unerläßliche Ordnung des Verhältnisses zwischen den Generationen und also, wenn man von Beherrschung reden will, Beherrschung der Generationsverhältnisse und nicht der Kinder? Und so auch Technik nicht Naturbeherrschung: Beherrschung vom Verhältnis von Natur und Menschheit." (Benjamin 1972: 147).

With this formulation, Benjamin arrives at an extraordinary insight: he captures a central problem of modern societies in an ingenious fashion. He concentrates on the results of relations of domination, stressing the need for reflexivity. We gain nothing, he says, if we insist on the right to dominate nature (assuming we

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352 Note the parallel to writers like Ernst Jünger or the Italian futurists; see Hinz (1985) for the latter.

wish to use that term). Instead, he continues, we should be able to control ("dominate") this relation. This formulation is congenial to Marx's project in that it stresses both the need for transforming nature with the help of technologies and the need to evaluate these transformations. Domination of nature thus becomes a reflexive concept.[353]

5.5. Conscious Control and Central Planning

5.5.1. Marx, Vico and social complexity

Marx derived part of his historical optimism from Vico and the tradition which followed him (cp. Berlin, 1976:94,137). Indeed, if Vico's claim were true, there would be a powerful reason to share Marx's optimism. As Marx indicated in a footnote in Capital 1, he agreed with Vico that man can understand the world which is his own product much better than the world of nature (which is, according to Vico, the product of God). Marx says:

> "Does not the history of the productive organs of man, of organs that are the material basis of all social organisation, deserve equal attention? And would not such a history be easier to compile, since, as Vico says, human history differs from natural history in this, that we have made the former, but not the latter?" (Capital 1:352).

It is noteworthy that many commentators have not noticed the important implications which follow from this claim. Marx is often charged with having overlooked the fact that nature will never be completely transformed. Alfred Schmidt also bases his criticism of

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353 See, also, Luhmann (1984a:644-5) who defines social rationality as the system's awareness of the reflexivity of its own operations on its environment.

Bloch on this line of argument: "Auch bei wachsender Vermittlung wird Natur nicht zu einem völlig von uns gemachten... Darin drückt sich das wesentlichste Unterscheidungsmerkmal von idealistischer und materialistischer Dialektik aus: es kommt bei Marx auch in einer wahrhaft menschlich gewordenen Welt nicht zur völligen Versöhnung von Subjekt und Objekt. Dies macht Blochs identitäts-philosophische Hoffnung zuschanden." (Schmidt 1971:162) But Schmidt neglects the more basic problem: (even granted that nature and society could be reconciled) what if human creations still cannot be conceived as human creations and thus not fully understood?[354] In other words, what if the social sphere loses its privileged cognitive status?

After all, it is only natural for us to doubt such a privileged status for the social sciences: did not the positivists charge the humanities with indulging in unscientific enterprises and of pretending to have gained knowledge about non-natural things? The motivation for this attack came from their experience of self-proclaimed human sciences, such as Marxism and Psychoanalysis on the background of a fundamental crisis of the exact sciences such as physics and mathematics.[355] It would be interesting to examine how different epochs (and different writers) have seen this cognitive problem - a task which lies outside the framework of this study. What I want to do here is to formulate some doubts

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354 Marx faces this problem when he discusses a possible "deviation" of technologies from human abilities. However, he assumes a strong functional mechanism to be at work here which links human abilities to existing productive forces. See CW 5:87-8 and Capital 1:488.

355 How strong this positivist influence was (and still is), we can see if we look at commonsense opinions regarding this problem. It is a widespread view that the natural sciences are able to know more about nature than the social sciences about society.

regarding Marx's privileging of "the social" with respect to cognition. I do this by looking at some results of contemporary social research.

Todd La Porte, in his seminal Organised Social Complexity (1975) observed that

> "[O]ne particulary striking aspect of modern political and social development has been the capacity of men to construct social systems encompassing more and more groups. Our lives are bounded by agencies, organizations, combines, coalitions, and associations: networks of hundreds of connected groups and persons... One consequence of these increases in group connections... has been the tightening of organiszational dependencies affecting social dynamics and political movements. Another has been a rapid increase in the numver of people and agencies affecting the day-to-day experiences of individuals. Closely related to this increase has been one in the number of surprises we encounter. They are generally disturbing surprises, caused by the interruption or frustration of our expectation by some hitherto unrecognized dependency." (La Porte 1975:3)

La Porte calls this a condition of social complexity - to be more precise, of organized social complexity. "Systems that are characterized by organized complexity... are those in which there is at least a moderate number of varaibles or parts related to each other in organic or interdependent ways." (1975:5). The most obvious empirical referents are "social groups with conscious purposes, such as formal organizations or informal, but cohesive, groups and associations." (1975:6) It is imp. Important that these systems are self-conscious in order that their interaction can count as organized. La Porte then provides a working definition of organized social complexity: "The degree of complexity of organized social systems (Q) is a function of the number of system components (C_i), the relative differentiation or variety of these

components(D_j), and the degree of interdependence among these components (I_k). Then, by definition, the greater C_i, D_j, and I_k, the greater the complexity of the organized system (Q)." (La Porte 1975:6) La Porte concludes: "[I]f it is true that the texture of life and its social institutions has become increasingly complex and can be expected to continue so, the implications for social theory, for political science, for the techniques of inquiry, and - perhaps most important - for public policy are enormous." (La Porte 1975:18)

Now this is obviously an argument which presents a strong challenge to the Vico-Marx position.[356] For if these are pervasive traits of modern societies, Marx's hope for an abolition of fetishism, for a full reapropriation of man's objectivations, for a "reconcilation", is doomed. It is not doomed because of an "indissolvable" rest of nature, which cannot be transformed, but for the opposite reason: even if mankind succeeds very well in transforming nature we have to take into account the paradoxical result that it now suffers from social opacity. The process which leads to such a result is the development of the productive forces, which have grown not only in efficiency but also in size: as Marx himself was aware, the relation between individual (craft worker) and technology (his craft instrument on which he played like a virtuoso) was reversed with the advent of modern industry. To run certain technologies, it is indispensable to have a whole network of social institutions. Immediately connected to this diagnosis is

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356 The challenge becomes even stronger if we assume that ecological problems arise out of an interplay between social and natural processes, both (at times) poorly understood - not to speak of their complex interaction. How little we know in this respect can be grasped from the discussion which followed the publication of several "world-models" (Club of Rome and others) which tried to connect several factors in an obviously unsatisfying way.

the question of planning, or of "social steering". I am not only lacking space but also competence to discuss the different judgements on the prospects of planning in complex societies.[357] I only want to bring out a theoretical dilemma (which seems to be also a historical one) and which Marx did not confront.

Recall his distinction between ancient societies and communism. In ancient societies people were dependent on nature to a big degree. Their "mastery" of nature is on a low level. To this corresponds a mystical world view: nature is essentially an opaque thing for human beings, whereas social relations in ancient societies are transparent. Communist societies, on the other hand, have succeeded in transforming nature into second nature, resulting in a (nearly) transparent nature and a transparent society. In between ancient and communist societies lie societies which, to differing degrees exhibit natural and social opacity; but the gross course of history seems to follow a road on which natural opacity decreases and social opacity increases - up to a point (capitalism) where, according to Marx, the social realm is most opaque, but the possibilities to break it up increase proportionally. But this mechanism is a rather speculative one. Marx excludes the possibility that social opacity cannot be blasted away, but perhaps at most reduced. The growth of productive forces has led to a decrease in natural opacity but also to an increase in social opacity. Whereas Marx saw this opacity as a result of false reality which could be transformed into a true reality, some contemporary sociologists are more sceptical. They explain social opacity by social complexity which cannot be abolished. In other words, the "inverted world" (Marx) presents an irreversible stage of social evolution. According to their approach, the evil has to be located

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357 See the contributions of La Porte, Perrow, Mayntz, Scharpf, Luhmann, Teubner, Willke and others.

more deeply than Marx locates it. If they are right, then Marx's assumption that with the abolition of capitalism fragmentation and alienation would also vanish must be regarded as obsolete. I return to this question in 5.6.

5.5.2. Central planning?

In 5.1., I made the distinction between a weak and a strong notion of communism. The decisive difference has been identified in the existence of alienation and fetishism. However, according to Marx, alienation and fetishism have their social roots in privately producing units i.e. under market conditions. The dichotomy market/plan becomes most important here. As we shall see, Marx was not very clear about the survival of markets in communism and the role of central planning. Take, first, his assertion in Capital that "only products of different labour processes, carried on independently for the accounts of different private individuals, confront one another as commodities." (Capital 1:49, amended translation) This qualification enables Marx to claim that a socialist economy which has abolished exploitation, but continues to exchange products, is also free of commodity fetishism, since its products are no commodities. But this claim overlooks the fact that if different units of production (for example, workers' cooperatives) under socialism exchange products with each other, these products assume the form of commodities since they are use-value and exchange-value at one and the same time. Marx offers only a verbal resistance to such a conclusion by insisting that the different units of production must be carried on by private individuals in order that their products assume the form of commodities (which, rather than providing a solution, begs the question). The whole problem therefore seems to come down to the question of market and plan.

Before going into detail, a preliminary remark is in order. Up to now, I have quoted several passages from Marx where he speaks of "conscious control" or a "settled plan" which would be necessary for a communist society. I should like to stress that these notions are philosophical and abstract notions. We cannot, therefore, immediately derive from them an answer to the question if Marx was in favour of central planning or not. And, what is more, he might even have opposed central planning if it came into opposition with the "conscious control" i.e. if the side-effects and irrationalities of central planning would have thwarted the full conscious self-control of mankind's fate. As I shall claim, Marx's theoretical framework requires both markets and plan. Marx needs markets for the transformation of concrete labour into abstract labour, and he needs the plan to establish the social character of labour from the outset. There is no way out of this dilemma.

As to the first, Marx criticised Proudhon and the Ricardian socialists Bray and Gray several times for their proposal to abolish money and substitute it with certificates for labour time.[358] Marx's main point of criticism is that their solution would be self-defeating, since it proposes that goods be produced, but not exchanged, as commodities (cf. Moore 1980:73; see also Cohen 1978:127-8). Marx never proposed to "count any two hours of concrete labour as equivalent. This is the solution of Proudhon and Dühring, but not that of Marx." (Moore 1980:73)[359]. Instead,

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358 See CW 29:320ff.

359 See Marx: "Complicated labour ... [is] labour of greater intensity and greater specific gravity ... [which] resolves itself into simple labour put together; it is simple labour raised to a higher power, so that for example one day of skilled labour may equal three days of simple labour." (CW 29:273)

claims Moore, Marx was looking for a mechanism to translate concrete labour into abstract labour, since he was constantly aware of every societies' need to perform this transformation. In a letter to Kugelmann he writes "That this necessity of the distribution of social labour in definite proportions cannot possibly be done away with by a particular form of social production but can only change the mode of appearance, is self-evident." (SW 2:419).

In A Contribution to the Critique of Politcal Economy, Marx explains:

> To measure the exchange values of commodities by the labour time they contain, the different kinds of labour have to be reduced to uniform, homogeneous, simple labour, in short to labour of uniform quality, whose only difference, therefore, is quantity. This reduction appears to be an abstraction, but it is an abstraction which is made every day in the social process of production. The conversion of all commodities into labour time is no greater an abstraction, and is no less real, than the resolution of all organic bodies into air." (CW 29:272).

But how, then, translate and measure more complicated labour? Here Marx relies on the reality of bourgeois society which has already brought about the transformation of a great part of social labour into simple labour: "The greater part of the labour performed in bourgeois society is simple labour as statistical data show." (CW 29:273). But what, then, about the smaller part of complicated labour? How is the reduction brought about? Marx's answer in this text is evasive when he says: "The laws governing this reduction do not concern us here." (CW 29:273).

Eight years later, in the first volume of Capital, Marx conceives of labour performed under conditions of modern industry as nearly completely simple labour: "Hence, in the place of hierarchy

of specialsied workmen that characterises manufacture, there steps, in the automatic factory, a tendency to equalise and reduce to one and the same level every kind of work that has to be done by the minders of the machines..." (Capital 1:396)[360].

Finally, consider the following passage from the Manuscripts 1861-63:

> Was aber die individuelle Verschiedenheit der Arbeiter betrifft, die dieselbe Arbeit verrichten, so ist darüber folgendes zu bemerken: Diese Verschiedenheit am größten im handwerksmässigen Betrieb (und in den höhren Sphären der s.g. unproduktiven Arbeit.) Sie verschwindet mehr und mehr und ist auf kaum zu berechenbaren Spielraum beschränkt in der entwickelten capitalistischen Production, wo Theilung der Arbeit und Maschinerie vorherrscht." (MEGA II.3.1.:209)

To turn to the other horn of the dilemma. Marx never tires of demanding that labour be directly part of the aggregate labour of society, that it not only acquires this social character post festum, through the market, but from the outset. This insistence derives from his insight that fetishism and alienation arise only in conditions under which the producers are separated from each other, where "fragmentation has become the normal state of affairs" (MEGA II.3.6.:2181), where products assume the form of value - in a word: in market economies. From this insight follows his proposal to abolish markets and to substitute them with a central plan:

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360 Heller suggests that this was Marx's solution for the transformation problem of complicated into simple labour for communist society too. At first sight this view seems compelling and it also corresponds to Marx's evolutionary approach that the new must already be visible beneath the old form. Nevertheless, it cannot be regarded as a solution at all (for the reasons see infra).

> If we conceive society as being not capitalistic but communistic, there will be no money-capital at all in the first place, not the disguises cloaking the transactions arising on account of it. The question then comes down to the need of society to calculate beforehand how much labour, means of production, and means of subsistence it can invest ... In capitalist society however where social reason always asserts itself only post festum great disturbances may and must constantly occur." (Capital 2:318-9).

Note that society is conceived here to calculate labour quanta. However, Marx does not tell us how this should be done. He only suggests that producers may now get paper certificates for their performed work:

> "In case of socialised production the money-capital is eliminated. Society distributes labour-power and means of production to the different branches of production. The producers may, for all it matters, receive paper vouchers entitling them to withdraw from the social supplies of consumer goods a quantity corresponding to their labour time. These vouchers are not money. They do not circulate." (Capital 2:362).

There are several problems with that solution. The first is that labour has been reduced to simple, homogenous labour in order that it can be compared. However, this does not match with Marx's position that the character of labour under communism will definitely be different from that under capitalism, a point to which I come in a moment. Another difficulty is that Marx thinks that these vouchers would not circulate. But who would ensure this? Would it not be natural to assume that they get exchanged,

that a market of labour vouchers would emerge?[361]

In the Critique of the Gotha Programme, Marx runs into a difficulty when he claims on the one hand that in the first stage of communism each should be rewarded according to her labour contribution, but, on the other hand, recognizes that labour is heterogenous i.e. different workers perform different amounts of labour in a given time period (see SW 3:18-9).

To summarise the argument so far. In order to abolish fetishism, Marx needs to abolish labour markets; in order to calculate the ratios of concrete and abstract labour, he needs to retain markets.[362] My claim is that Marx employs the term "conscious control" to cover two different principles of organising the economy: market and plan. Note that market and plan are not as such incompatible; mixed economies or market socialism may be feasible social forms.[363] In the Civil War in France, Marx in fact

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361 Note that Marx at this point takes up the proposal of the Ricardian socialists, and of Proudhon, to substitute money for such vouchers. The difference is that production now is socialised - Marx is therefore consistent in criticising their proposal and to propose something similar here. (But note how uncomfortable he feels: he says meinetwegen they may receive paper vouchers...)

362 See Kosta, Meyer, Weber (1973:99ff.) who report about attempts in the GDR to measure complicated labour without markets.

363 See Moore for a position that the Communist Manifesto contains a model of market socialism which Marx was later to abandon. (Moore 1980:66-70). Social theory has developed the following concepts to distinguish between three forms of socialization. Luhmann (1984a:522) distinguishes between competition, cooperation and exchange; Elster, following Polanyi, distinguishes between market, planning and

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seems to combine markets and plan:

> [Those] memebers of the ruling class who are intelligent enough to perceive the impossibility of continuing the present system - and they are many - have become the obtrusive and full-mouthed apostles of co-operative production. If co-operative production is not to remain a sham and snare; if it is to supersede the Capitalist system; if united co-operative societies are to regulate national production upon a common plan, thus taking it under their own control, and putting an end to the constant anarchy and periodical convulsions which are the fatality of Capitalist production - what else, gentlemen, would it be but Communism, 'possible' Communism? (CW 22:335)

What makes markets and plan incompatible in Marx is that he - albeit indirectly - focuses on labour-markets. Either labour is sold and bought on markets, or it is directly connected to social labour within a central plan - a middle way seems excluded.

Heller, as already noted, maintains that in the Grundrisse and Capital Marx had different concepts of labour. In the Grundrisse,

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> reciprocity. These two typologies are different, but also overlapping. I propose to fuse them under the headings of market, state and solidarity. Now, it seems that any modern society employs all of the three mechanisms. A simple thought can illustrate this. Take first the plan: if it is not perfect (and who would assume it can be?), there will always emerge a market besides the plan - albeit a black market. (Above we saw that it would be natural to assume the circulation of labour-vouchers. Similarly, it would be absurd for a "free" society to simply forbid markets). Likewise, if the market does not work perfectly (and who would assume it does?), some redistributive measures must be taken by the state. Finally, solidarity seems to always operate in social relations, at least on the micro-level (families) but also on higher levels (agreements between firms, institutions etc.).

Marx views labour as a vital need, whereas in Capital he views it as a social duty. To this contrast corresponds, according to Heller, labour as complicated labour in the Grundrisse and labour as simple labour in Capital. Now if this were true, Marx's market dilemma could be resolved easily: since all labour is homogenous simple labour, there is no need to have markets which transform concrete into abstract labour; they can be equated from the outset; the many individual labours can be aggregated to a social labour via plan.

But Heller's claim is misconceived. She forgets that we have to distinguish between Marx's analysis of labour under capitalism and his prediction about the character of labour under communism. Without doubt Heller's reference to Marx's analysis of labour in the Grundrisse refers to a communist society whereas the analysis of Capital is concerned with the labour performed under present capitalist conditions.

If my exegetical analysis in chapter 3 was right, then Heller's claim is even more misplaced. In 3.5., I maintained that Marx, in the Grundrisse and in the Manuscripts 1861-63, stresses the fact that the workers get reduced to mere appendages to machinery (as a result of technological conditions) whereas in Capital he limits this fact to capitalist society. This is to say that the reduction of complex labour to simple labour is done only under capitalist relations. In other words, it is no technological but a social fact that all labour becomes homogenous, simple, repelling, monotonous work. But Marx, in the Grundrisse and the Manuscripts 1861-63, presents this fact also as a technological fact: simple labour which exists under capitalism is largely predetermined by the rhythm of the machine.

Labour gets reduced to simple labour under capitalist conditions, but will it retain this character in communism? Obviously not, if we look at Marx's own writings. I already quoted the passage from Capital where Marx stresses the need for varied work which becomes realised first under capitalist relations. Certainly, one could say that varied work may be at the same time simple work - in this case, Heller's contention would be right. But Marx in Capital also stresses the need for an all-round education which is a clear sign that labour cannot be conceived as simple work.[364] In my view, Marx did not change his basic position in respect of labour from the Grundrisse to Capital. But he has moved into a dilemma whose two aspects are the following: either he has a consistent position in favour of labour markets which transform complex into simple labour; but this solution entails the danger of fetishism and alienation. Or he has a consistent position in favour of planned labour allocation - in which case he has to assume that labour under communism has the same character as under capitalism.

5.5.3. Social complexity and personal differences

In this section, I briefly point to an apparent difficulty with Marx's concept of communism which rests on the contention of many critics that Marx undervalued (i) the importance of personal conflicts and (ii) the importance of social functions. I address these two points in turn.

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364 Marx never abandoned his philosophical anthropology with the central notion of "total individuals".

Marx repeatedly stated that individuals were different.[365] However, he seemed to believe that only under conditions of class societies, especially capitalism, would personal differences turn into conflicts. With the abolition of private property and classes, he argues, personal differences can be put to the benefit of all instead of turning into conflicts between individuals. In the German Ideology, Marx and Engels assert that "with the abolition of the basis, private property, with the communistic regulation of production (and implicit in this, the abolition of the alien attitude [Fremdheit] of men to their own product), the power of the relation of supply and demand is dissolved into nothing, and men once more gain control of exchange and the way they behave to one another..." (CW 5:48). In the Communist Manifesto, we read: "In place of the old bourgeois society, with its classes and class antagonisms, we shall have an association, in which the free development of each is the condition for the free development of all." (CW 6:506) In the Comments on James Mill, we read: "Let us suppose that we had carried out production as human beings. Each of us would have in two ways affirmed himself and the other person. (1) In my production I would have objectified my individuality, its specific character, and therefore enjoyed not only an individual manifestation of my life during the activity, but also when looking at the object I would have the individual pleasure of knowing my personality to be objective, visible to the senses and hence a power beyond all doubt. (2) In your enjoyment or use of my product I would have the direct enjoyment both of being conscious of having satisfied a human need by my work, that is, of having objectified man's essential nature, and of having thus created an object corresponding to another man's essential nature... I would have directly confirmed and realized my true

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365 cf. 1859 Preface, The Critique of the Gotha Programme.

nature, my human nature, my communal nature. Our products would be so many mirrors in which we saw reflected our essential nature." (CW 3: 227-8).

As far as this argument rests on the assumption of limitless material abundance it must be rejected on the grounds that Marx himself gave: there will never be a society with limitless material abundance. As far as the argument rests on the assumption that personal endowments and interests can be chanelled via a division of labour to the benefit of all, it seems to presuppose an irrealistic notion of social harmony. As Elster pointed out, "[e]ven assuming people to be moved by altruism or a concern for the common good, they might not have a common conception of what that good is." (Elster 1985:458). Marx could agree with such an account, arguing that this is characteristic of the first stage of communism, which is "in every respect, economically, morally and intellectually, still stamped with the birth marks of the old society from whose womb it emerges." (SW 3:23) And in the early Paris Manuscripts, Marx conceives of a "crude communism" which may well correspond to the two stages in the Gotha Programme. Marx writes:

> This type of communism - since it negates the personality of man in every sphere - is but the logical expression of private property, which is this negation. General envy constituting itself as a power is the disguise in which greed re-establishes and satisfies itself, only in another way. The thought of every piece of private property as such is at least turned against wealthier private property in the form of envy and urge to reduce things to a common level, so that this envy and urge even constitute the essence of competition. Crude communism is only the cumulation of this envy and of this levelling-down

> proceding from the preconceived minimum." (CW 3:295)[366].

Maihofer pointed out that for this reason law as a social function would be indispensable for communist society.[367] Now this seems to contradict Marx's hope of a "withering away of the state". Maihofer and others have claimed that Marx never entertained such a hope. What Marx actually said, was that "public power loses its political character" and that the proletariat will install an association in place of the old bourgeois society which excludes the existence of classes and the conflict between them.[368] But consider Marx's comments (On the Jewish Question) on the "perfect" state as embodiment of the universal:

> "The perfect political state is, by its nature, man's species-life, as opposed to his material life. All the preconditions of this egoistic life continue to exist in civil society outside the sphere of the state, but as qualities of civil society. Where the political state has attained its true development, man - not only in thought, in consciousness, but in reality, in life - leads a twofold life, a heavenly and an earthy life: life in the political community, in which he considers himself a communal being, and life ind civil society, in which he acts as a private individual, regards other men as a

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366 In both texts, according to Marx, all memebers of society are workers. As Elster pointed out, "what Marx in his youth saw as a blind alley, he later cam to see as a necessary, if transitional stage." (Elster 1985:452)

367 See Lukes (1985:98ff.) for an eloquent exposition of further reasons.

368 See Communist Manifesto and Poverty of Philosophy. According to Maihofer, the formula of withering away of the state was Engels's invention. However, and ironically, Engels himself envisages a "Gemeinwesen" which organizes the association of communist society. See Maihofer (1968:14 ff.); see also Zolo (1974).

> means, degrades himself into a means, and becomes the plaything of alien powers." (CW 3:153-4, my emphasis).

From this Marx concludes:

> "Only when the real, individual man re-absorbs in himself the abstract citoyen, and as an individual human being has become a species-being in his everyday life, in his particular work, and in his particular situation, only when man has recogised and organised his "forces propres" as social forces, and consequently no longer separates social power from himself in the shape of political power, only then will human emancipation have been accomplished." (CW 3:168)[369].

It is not only that the bourgeois has to be eradicated in order to retain the life of the citoyen, it is rather the whole separation which Marx aims to supersede (in the sense of "aufheben"). This follows clearly from Marx's treatment of the bourgeois state as an instance for alienation:

> Out of this very contradiction between particular and the common interests, the common interest assumes an independent form as the state, which is divorced from the real individual and collective interests, and at the same time as an illusory community... (CW5:46).

Elster convincingly argued that all debates and procedures of allocation of resources and of finding solutions to social problems are likely to assume a political character. This leads me to

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369 This is a theme which has been taken up again by the communitarian critique of liberalism. Communitarians want to fuse public and private, political and moral dimensions. Interestingly, they seem to commit the same fallacy in assimilating the "self-rule" of society to that of an individual. However, to use Elster's words here in criticizing Marx, "this is a scale-error of monumental size and importance", cf. Elster (1985:458).

the second question i.e. if Marx also overlooked the need for the maintenance of social functions such as law, economy, politics etc. in communist society.

We have already seen that Marx claimed that the state would lose its political character in communism. This seems to entail communism eradicating the political system altogether. Insofar as Marx or Marxists adhere to such a position, it must be regarded as basically unrealistic. As social research in this century has shown, there is a trend of "autonomisation of social spheres". One could even conceive of these social autonomisations as analogous to the autonomisation of the economy which Marx so brillantly analysed. But if it is true that such an autonomisation has taken place, it is improbable that it can be simply reversed. Writers like Habermas explicitly acknowledge that this social differentiation has to be interpreted as an "evolutionary achievement" which is to say that every modern complex society must work according to the laws of different social subsystems in which money and power are the two main means of steering (see Habermas 1981, vol. 2:499, 501).

Marx, on the one hand, seems open to such a position when he writes in the Critique of the Gotha Programme: "What social functions will remain in existence that are analogous to present state functions? This question can only be answered scientifically..." (SW 3:26) Equally open for the functional requirements of modern society (in this case of large-scale industry) was his position on education. As we saw, Marx claims that many-sided individuals will be needed by large-scale industry and that the educational system brings them forth. In the passage on child-labour he goes even as far as to use the requirements of modern industry as an argument for the inevitability of child-labour,

which to my view is a somewhat sinister statement.[370] In summary, Marx acknowledges the need of modern societies for having functionally separated social spheres; sometimes he even entertains a naive functionalist view assuming that the requirements of large-scale industry will be fulfilled automatically.

But on the other hand he clearly favours an abolition of social systems if and in so far they are superior powers and are experienced as fate by the individuals. He favoured a community model over a society model. But if the modern world is characterised by such objectifications like social systems which are essential to the functioning of society (whether based on "socialist" or "capitalist" principles) it seems impossible to bring them back completely into the realm of intersubjective action (Habermas' "Lebenswelt" or the communitarians "community") - which was Marx's hope in the Jewish Question (inter alia). This would only be possible on the condition that all social functions could be performed by small local communities. However, as several authors have pointed out, any complex society needs some large-scale institutions which are organised on a regional, national and international level and display some degree of centralisation. It seems obvious, therefore, that alienation is inevitable here (and it may already exist on lower levels, from the intersubjective dimension upwards).

How could we explain this ambiguity in Marx? Lukes suggested that there might be a contradiction between the individualistic and the communitarian impulses in Marx's thought:

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370 He should have separated more clearly between the capitalist need for child-labour and his reasons for favouring a combination of theoretical and practical education. The way it stands, it could be interpreted as if Marx would not resist the squandering of childrens' lives in the factories.

> "The notion of individuality, to which ... Marx was so much attached, ... which reached the nineteenth century through Romanticism, Goethe supplying its artisitc and Schleiermacher its metaphysical foundation - this notion prescribes that 'each individual is called or destined to realise his own incomparable image' (Simmel). The notion of community, to which Marx was no less attached, which is no less rooted in the Western political tradition, pictures individuals as finding their fulfilment in reciprocity and solidarity rather than competition and self-assertion, and in mutual identification in common activities and the pursuit of common purposes." (Lukes 1985:96)[371].

This argument would explain the first ambiguity i.e. the problem of personal conflicts. With respect to the second problem we have to look even more closely at the philosophical tradition Marx inherited. This is the task of the last section.

5.6. Technology and the Limits of the Philosophy of the Subject

Marx follows Hegel in assuming that the subject will reappropriate its own 'creations', its own objectifications. But, as Benhabib (and others) have shown, this assumption is dogmatic. Nothing guarantees or proves that there will be a subject or a reappropriation. Benhabib rightly pointed out that "Hegel's critique is based upon the normative image of a life form that has become 'transparent' and intelligible to the intellect, and in which

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371 As Schiller pointed out: "Nicht auf das Individuum bezieht sich dieser Bildungsprozeß, sondern auf den kollektiven Lebenszusammenhang des Volkes: 'Totalität des Charakters muß bei dem Volke gefunden werden, welches fähig und würdig sein soll, den Staat der Not mit dem Staat der Freiheit zu vertauschen.'" (Schiller, Sämtliche Werke, Bd.5:579; quoted in Habermas 1985:59)

individuals once again can recognize themselves as part of a 'living' as opposed to a 'dead' totality." (Benhabib 1986:30). But there is an ambivalence in Hegel's immanent critique of natural right theories which Marx was to inherit:

> "[O]n the one hand, he criticizes the dogmatism of modern natural right theories in reifying present social relations; on the other hand, he himself admits that there is no moment in the present upon which to anchor the view of a unified ethical life. The ideal of an ethical life is not an immanent but a transcendent ideal, in the sense that it involves looking back to the past." (Benhabib 1986:32)[372].

Marx, like Hegel, conceives of human culture as a historical product of man's objectifications; the objects are the expression of man's inner essence and are thus prone to a "reappropriation". This reappropriation becomes necessary because the actual course of history has led to an alienation of man from his objects. As Benhabib puts it,

> "Marx's early diagnosis of the antagonism inherent in bourgeois civil society clearly parallels the Hegelian one of Entzweiung. The principle of essential unity is denied methodologically, but it is reasserted at the normative level as the immanent utopia which Marx claims is the implicit 'ought' towards which actuality must evolve... The reappropriation of the powers and potentialities that humanity has alienated from itself is the dream." (Benhabib 1986:38,39).

If we cannot rely on a complete "Aufhebung" of alienation, we may

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372 See also Ricoeur (1986).

expect a reduction of alienation.[373] This is to say that from the two models of communism only the weaker one is available. To recall: the strong model is based on four elements:

1. reappropriation of all objectifcations;
2. total individuals;
3. conscious control;
4. production for use-value.[374]

These elements are three inseparable "moments" of the promethean image of mankind. Total individuals are individuals who have reappropriated their objectifications and have brought all their activities under their common conscious control.[375] This strong notion of communism clearly belongs to the notion Bildung of German Idealism (Humboldt, Herder) which Marx took up from Hegel's philosophy (but also from Feuerbach's materialism). As we have seen, it is contained both in Hegel's model of transformation of first nature into second nature which alone makes possible a rational character of the world and in Feuerbachs's critique of religion which Marx considered the starting point of all critique. According to him, in the emerging modern epoch, science, technology and bourgeoisie had to fight religious tutelage and free themselves from that grip. But, equally, the established modern

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373 Moore claims that Marx is able to reach the weak notion of communism on the basis of his historical materialism; the strong notion, however, can only be derived from his philosophical communism.

374 Production for use-value implies that markets are abolished, a conclusion which does not follow from Marx's analysis. In Capital, and the quoted passage from the Civil War, he leaves open the possibility that the economy, is, at least partly, based on exchange; but the products would then be commodities, a conclusion which he tries to avoid.

375 The notion of conscious control can be traced back to Dante, see Girnus (1974); Klein (1974).

epoch has to carry on the fight against every other form of "fate" or "alien powers".

It is thus up to the human species to acquire control over its own fate (social and natural processes) and to develop all of its species powers, as embodied in individuals.

Contrast now the weaker notion of communism:

1. abolition of private property;
2. abolition of classes, class-exploitation and class-oppression;
3. universalisation of happiness;
4. universalisation of material wealth;
5. expanding of disposable time.

I included (3) in this list since Marx thinks that people in former modes of production were happier (cf. MEGA II.3.6.:2288). But people in earlier modes of production certainly did not have full conscious control over their life-conditions: nature was an alien power, even if society was relatively transparent. Religious alienation was the normal state of these societies. I mention this only to show that (3) does not mean abolition of alienation. This is necessary to distinguish the weaker from the stronger notion of communism.[376]

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376 Marx (not only in his early writings) seemed to believe that with the abolition of private property all other points would follow more or less automatically; at least the following passage from the Paris Manuscripts can be interpreted in such a way: "Communism is the positive transcendence of private property, as human self-estrangement and therefore as the real appropriation of the human essence by and for man; communism therefore as the complete return of man to himself as a social (i.e. human) being - a return accomplishing consciously and embracing the entire wealth of previous development." (CW 3:296; cp. also MEGA II.3.6.:2144).

Let me now restate the problematique of the present work in the light of the above. Ecological problems are seen as the result of an autonomisation of the social and technical sphere. The human species has developed technologies in order to dominate nature; at a certain point in their development these technologies can no longer be controlled by individuals, but only by units of social cooperation. If we recall the evolutionary models from chapter 4, we might say that both technology and social forms have assumed a shape which escapes the control of the individuals. Both craft technology and transparent social relations (like families, guilds, towns) had dimensions which could be grasped by the individuals. Modern technologies are not at the disposal of individual craft workers; likewise, social life cannot be conceived as a family writ large.[377] Both stages of development display a sharp qualitative leap which any social theory has to recognise.[378]

Marx pointed to both phenomena: individuals under conditions of modern industry are reduced to "living accessories" who experience the (technical) world rather as "fate" than as a product of their conscious control. As he said, "in comparison with capitalist society, these old social organisms of production are far more simple and transparent." (Capital 1:83) Surely, science may reveal

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377 Teubner rightly notes that some socialist and corporatist theories wrongly equate functional subsystems of societies with big corporations, capable of action. (Teubner 1989b: 103). The same holds true with respect to some recent communitarian criticisms of liberalism (see also above, fn 368).

378 Adorno, in an article called "Fortschritt", clearly sees that Hegel and Marx were aware of this autonomisation of supra-individual entities. He also sees the mythical element in this process: "Innerweltlicher Fortschritt hat sein mythisches Moment daran, daß er, wie Hegel und Marx erkannten, über die Köpfe der Subjekte hinweg sich zuträgt und diese nach seinem Ebenbild formt..." (Adorno 1977:631-2).

more and more secrets and solve more and more puzzles - this is also the route which Marx embarks on in order to foster his historical optimism. However, his optimism goes as far as to assume that in principle there can, and will be, a state of affairs which would make social science superfluous. In other words, Marx seems to presuppose that communism will create social relations which are entirely transparent to their members. As Cohen put it:

> "Marx says that relations between human beings under socialism are 'transparent' and 'intelligible'. Economic agents whose actions are integrated by a democratically formulated plan understand what they are doing... [Social science] has no function in a world which has abolished the discrepancy between the surface of things and their true character." (Cohen 1978:336-7) "When social science is necessary, men do not understand themselves. A society in which men do not understand themselves is a defective society." (Cohen 1978:338)

This interpretation is in line with my emphasis that what counted most for Marx in the final analysis was the construction of a rational world. Cohen gives a - to my view - excellent interpretation of the eleventh thesis on Feuerbach. Marx says there: "The philosophers have only interpreted the world, in various ways; the point is to change it." Cohen rightly suggests interpreting this phrase not in the sense that Marx was (in contrast to Feuerbach) interested in practical questions. Rather, as Cohen suggests, we understand the meaning of the eleventh thesis best by adding "to change it so that interpretation of it is no longer necessary." (Cohen 1978:339, my emphasis)[379]

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379 See the Contribution to the Critique of Hegel's Philosophy of Law where Marx speaks about an "inverted world"; see CW:3:175.

This points to the essential equal concern of Feuerbach and Marx i.e. to suppress illusion, and it is "Marx's complaint... that theory alone will not do so. The goal with respect to which 'the chief thing still remains to be done' [4th thesis on Feuerbach, R.G.] is to secure intelligibility." (Cohen 1978:340). In other words: social reality must be such that it provides the conditions of intelligibility which initiate harmony between reality and thought. Fetishism, which gives rise to "false consciousness", does not mean that people are in principle unable to conceive reality. Rather, reality presents itself in the way in which it is represented by consciousness. It is up to science to "dissipate the mist" and provide explanations.[380] Cohen rightly connects this topic to the topic of alienation (and, I may add, he should have connected it to the topic of fetishism as well) and agrees with Marx's claim that the need for social theoretical explanation reflects an alienated state of affairs and he supports Marx's intention to overcome this situation in a future society (cf. Cohen 1978:343). However, Cohen notes that there are inherent limits for doing so. Even granted that the market, one of the main causes of social opacity, will have disappeared, there will probably remain other causes. According to my own view, these causes lie in the fact that social reality is functionally differentiated and complex. Social science is therefore needed more than ever before.

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380 This "realist" epistemology comes out very clearly in Marx's letter to Kugelmann of July 11, 1868: "Since the thought process itself grows out of conditions, is itself a natural process, thinking that really comprehends must always be the same, and can vary only gradually, according to the maturity of development, including the development of the organ by which the thinking is done." (SW 2:419).

BIBLIOGRAPHY

Quotations from Marx's own writings are given according to the work or the volume (A).
Quotations from other authors are given by indication of the year and the page (B).

A. WORKS OF MARX

On the Jewish Question (1843). In Marx Engels Collected Works (CW), vol. 3 London: Lawrence and Wishart.

Zur Kritik der Hegelschen Rechtsphilosohie. Einleitung. (1844) In: Marx Engels Werke (MEW) Band 1 (1844) Berlin: Dietz.

Contribution to the Critique of Hegel's Philosophy of Law. Introduction. (1844) in CW 3.

Comments on James Mill, Elements d'Economie politique. (1844) In CW 3.

Ökonomisch-Philosophische Manuskripte aus dem Jahre 1844, zit. als "Pariser Manuskripte". In MEW Ergänzungsband (EB) I (1974).

Economic and Philosophic Manuscripts (1844) cited as "Paris Manuscripts", in CW 3

The Holy Family. In CW 4

Letter to Annenkow, 28.12. 1846, in CW 38

Thesis on Feuerbach, in CW 5

(with F. Engels) The German Ideology. CW 5 Die Deutsche Ideologie. MEW 3

The Misery of Philosophy (1847), in CW 6

(with F. Engels) The Communist Manifesto (1848), in CW 6

(with F. Engels) Review of "G. Daumer, Die Religion des Neuen Weltalters" (1850) in CW 10

The Eighteenth Brumaire of Louis Bonaparte. In CW 11

"Speech at the Anniversary of the People's Paper" April 14, 1856 in CW 14

Grundrisse (1857-8, German ed.1953) Berlin: Dietz; cited as Grundrisse, Berlin

Grundrisse (transl. by M. Nicolaus) 1973, Harmondsworth: Penguin.

Original Text of A Contribution to the Critique of Politcal Economy. in CW 29

A Contribution to the Critique of Political Economy. In CW 29

Letter to Lassalle, 16.1.1861 in CW 41

Letters to Engels, 6.3. 1862; 18.6. 1862; 24.1. 1863; 28.1. 1863 in CW 41

Theorien über den Mehrwert (1861-63) in: MEW 26.1-26.3.

Zur Kritik der Politischen Ökonomie. Manuskript 1861-63 (1975-1982) in Marx-Engels-Gesamtausgabe, Abteilung II, vols. 3.1.-3.6. Berlin: Dietz. Cited as Manuscripts 1861-63, MEGA II.3.#.

Resultate des unmittelbaren Produktionsprozesses. (1861-63), Frankfurt am Main: Neue Kritik (1971)

Das Kapital, Bd. 1-3 in: MEW 23-25

Capital, Vol 1-3. London: Lawrence and Wishart.

Briefe über das Kapital. (1954) Berlin: Dietz.

Marx and Engels: Basic Writings on Politics and Philosophy. L. Feuer (ed.) (1969) London: Fontana.

Letter to F. Engels 8.1.1868, in CW 42

Letters to Kugelmann 11.7.1868, 27.6. 1870 and 17.4. 1871. In MEW 32

The Civil War in France. (1871) in CW 22

Critique of the Gotha Programme. (1875) in: Selected Works (SW) Vol. 3. Moscow: Progress.

B. SECONDARY WORKS

ADLER, Max (1964) Natur und Gesellschaft. Soziologie des Marxismus. Wien:

ADORNO, Theodor W. (1972) "Thesen über Bedürfnis" Gesammelte Schriften Bd. 8. Frankfurt am Main: Suhrkamp.

_____ (1944) "Minima Moralia" Gesammelte Schriften Bd. 4, Frankfurt am Main: Suhrkamp.

_____ (1968) "Aus Sils Maria" Gesammelte Schriften Bd. 10,1 Frankfurt am Main: Suhrkamp.

_____ (1977) "Fortschritt" in Gesammelte Schriften Bd. 10,2 Frankfurt am Main: Suhrkamp.

ADORNO, Theodor und HORKHEIMER, Max (1981) Dialektik der Aufklärung. Gesammelte Schriften Bd. 3. Frankfurt am Main: Suhrkamp.

ALTHUSSER, Louis/BALIBAR, Etienne (1970) Reading Capital. London: New Left Books

AMBURGERY, Terry and Donald McQUARIE (1977) "System Change in Karl Marx's Model of Socio-economic Formation" in 22 General Systems 99

AMERY, Carl (1978) Natur als Politik. Die ökologische Chance des Menschen. Reinbek: Rowohlt

ANDERSON, Perry (1976) Considerations on Western Marxism. London: New Left Books

ARATO, Andrew and BREINES, Paul (1979) The young Lukacs and the Origins of Western Marxism. New York:

ARCHER, Margaret S. (1987) "Resisting the Revival of Relativism" in 2 International Sociology 235

ARENDT, Hannah (1958) The Human Condition. Chicago (Ill.): Chicago University Press

_____ (1981) Vita activa oder vom tätigen Leben. München: Piper.

AVINERI, Shlomo (1968) The Social and Political Thought of Karl Marx. Cambridge: Cambridge University Press

_____(1972) Hegel's Theory of the Modern State. London: Cambridge University Press

BACON, Francis (1986) Novum Organon. The Works of F. Bacon, vol 4. Stuttgart-Bad Cannstatt: frommann-holzboog

BÄTZING, Werner (1984) Die Alpen. Frankfurt am Main: Sendler

BAHR, Hans-Dieter (1983) Über den Umgang mit Maschinen. Tübingen: Konkurs- buchverlag

BAHRO, Rudolf (1977) Die Alternative. Köln/Frankfurt am Main: Europäische Verlagsanstalt.

_____ (1982) Wahnsinn mit Methode. Über die Logik der Blockkonfrontation, die Friedensbewegung, die Sowjetunion und die DKP. Berlin:

BALL, Terence (1979) "Marx and Darwin: A Reconsideration" 7, Political Theory 469

BALLMER, T. und WEIZSÄCKER, Ernst von (1974) "Biogenese und Selbstorganisation", in: E. von Weizsäcker (Hg.) Offene Systeme I: Beiträge zur Zeitstruktur von Information, Entropie und Evolution. Stuttgart: Klett.

BARNES, Barry (1977) Interests and the Growth of Knowledge. London: Routledge

BATESON, Gregory (1979) Geist und Natur. Frankfurt am Main:: Suhrkamp

BECKER, Werner (1975) "Dialektische Methode und der Sachverhalt der Entfremdung." Hegel-Jahrbuch 1974 Hg. W.R. Beyer, Köln: Pahl-Rugenstein, 396-399

BECKERMAN, Wilfred (1976) In Defence of Economic Growth. London: Jonathan Cape

BEDAU, Hugo Adam (1984) "Why do we have the Rights we do?" 1, Social Philosophy and Policy 56

van den BELT, Henk and Arie RIP (1987) "The Nelson-Winter-Dosi Model and Synthetic Dye Industry" in W. Bijker, Th.P. Hughes and T. Pinch (eds.) The Social Construction of Technological Systems. Cambridge (Mass.): The MIT Press

BENHABIB, Seyla (1986) Critique, Norm, and Utopia. A Study in the Foundations of Critical Theory. New York: Columbia Universty Press

BENJAMIN, Walter (1942/1974) "Über den Begriff der Geschichte." Gesammelte Schriften I.2., Frankfurt am Main: Suhrkamp

_____(1973) Illuminations. London: Fontana

_____(1972) "Einbahnstraße" in Gesammelte Schriften IV.1, Frankfurt am Main: Suhrkamp

_____(1982) "Das Passagen-Werk. Aufzeichnungen und Materialien" in Gesammelte Schriften V.1, Frankfurt am Main: Suhrkamp

BERG, Maxine (1982) The Machinery Question and the Making of Political Economy. Cambridge: Cambridge University Press

BERGER, Johannes and Claus OFFE (1982) "Functionalism vs. Rational Choice? Some Questions Concerning the Rationality of Chosing One or the Other" 11 Theory and Society 521

BERLIN, Isaah (1963) Karl Marx. His Life and Environment. Oxford: Oxford University Press.

_____ (1976) Vico and Herder. London: The Hogarth Press.

BINSWANGER, Hans Cristoph (1985) Geld und Magie. Stuttgart: Edition Weitbrecht

BIRCH, Thomas H. (1982) "Man the Beneficiary? A Planetary Perspective on the Logic of Wildlife Preservation" in N. Barrett (ed.) International Diemnsions of the Environmetal Crisis. Boulder (Col.): Westview

BIRNBACHER, Dieter (1980) "Sind wir für die Natur verantwortlich?" in D. Birnbacher (ed.) Ökologie und Ethik. Stuttgart: Reclam

BLOCH, Ernst (1959) Das Prinzip Hoffnung. Berlin: Aufbau (3 Vols.)

BLOOR, David (1976) Knowledge and Social Imaginery. London: Routledge

BODEI, Remo (1983) "Risorse, macchine, emancipazione in Marx (1857-1867)" 3 Teoria 13

BOOKCHIN, Murray (1977) Die Formen der Freiheit. Aufsätze über Ökologie und Anarchismus. Telgte-Westbevern:

BORGMANN, Albert (1982) "Technology and Nature in Europe and America" in N. Barrett (ed.) International Dimensions of the Environmental Crisis. Boulder (Col.): Westview

BOSERUP, Ester (1981) Population and Technology. Oxford: Blackwell

BOURDIEU, Pierre (1981) "Men and Machines" in K. Knorr-Cetina (ed.) Advances in Social Theory and Methodology

BRENKERT, George G. (1980) "Freedom and Private Property in Marx", in COHEN, Marshall; Thomas NAGEL, and Thomas SCANLON, (eds.) Marx, Justice and History. Princeton: Princeton University Press

BREUER, Stefan (1987) "Adorno, Luhmann. Konvergenzen und Divergenzen von Kritischer Theorie und Systemtheorie" in Leviathan 91

BUCHANAN, Allen E. (1983) "Review of Allen W. Wood, Karl Marx" in 80, Journal of Philosophy 426

BÜHL, Walter (1987) "Die Grenzen der Autopoiesis" in 39 Kölner Zeitschrift fÜr Soziologie und Sozialphilosophie 225

CALLON, Michel (1987) "Society in the Making: "The Study of Technology as a Tool for Sociological Analysis" in W. Bijker, Th.P. Hughes and T. Pinch (eds.) The Social Construction of Technological Systems. Cambridge (Mass.): The MIT Press

CARLYLE, Thomas (1980) The Works of Thomas Carlyle in H.D. Traill (ed.), 2nd imprint, New York: AMS Press

CARSON, Rachel (1962) Silent Spring. Boston: Houghton Mifflen

CARVER, Terrell (1976) "Marx - and Hegel's Logic" Political Studies

CHANNEL, David F. (1988) "Engineering Science as Theory and Practice" 29 Technology and Culture 98

CHAVANCE, Bernard (ed.)(1985) Marx en Perspective. Actes du Colloque organise par l'Ecole des Hautes Etudes en Sciences Sociales. Paris: Editions de l'Ecole des Etudes en Sciences Sociales

COHEN, Joshua (1982) "Karl Marx's Theory of History: A Defence." (Review) in 79 Journal of Philosophy 253

COHEN, Gerald A. (1978) Karl Marx's Theory of History: A Defence. Oxford: Clarendon

_____ (1980) "Functional Explanation: Reply to Elster" in 28, Political Studies 129

_____ (1982) "Functional Explanation, Consequence Explanation, and Marxism" 25, Inquiry 27

_____ (1983) "Reconsidering Historical Materialism" in J.R. Penncock and J.W. Chapman (eds.) Marxism: Nomos XXVI. New York: New York University Press 227

COHEN, Gerald A. and KYMLICKA, Will (1988) "Human Nature and Social Change in the Marxist Conception of History" in 85 Journal of Philosophy 171

COHEN, Marshall; NAGEL, Thomas and SCANLON, Thomas (eds.) (1980), Marx, Justice and History. Princeton: Princeton University Press

COMMONER, Barry (1971) The Closing Circle. London: Cape

CONSTANT, Edward W (1987) "The Social Locus of technological Practice: Community, System, or Organization?" in Bijker, Hughes and Pich (eds.) The Social Construction of Technological Systems, op. cit

van den DAELE, Wolfgang (1987) "Der Traum von der 'alternativen' Wissenschaft" in 16, Zeitschrift für Soziologie 403

DAHL, Robert A. and LINDBLOM, Charles A. (1953) Politics, Economics and Welfare. Chicago: Chicago University Press

DALY, Hermann (ed.) (1973) Economics, Ecology, Ethics. Essays Toward a steady-state Economy. San Francisco/New York: Freeman

_____(1982) "Three visions of the Economic Process" in N. Barrett (ed.) International Dimensions of the Environmental Crisis. Boulder (Col.): Westview

DARWIN, Charles (1859/1971) The Origin of Species. (reprint of the sixth edition) London: Dent & Sons

DAWKIN, Richard (1976) The Selfish Gene. Oxford: Oxford University Press

DOSI, Giovanni (1984) Technical Change and Industrial Transformation. London: Macmillan

DWORKIN, Ronald (1978) Taking Rights Seriously. (Rev. ed.) London: Duckworth

EIGEN, Manfred and Peter SCHUSTER (1977) "The Hypercycle. Part A" in 64 Naturwissenschaften 541

_____ (1978a) "The Hypercycle. Part B" in 65 Naturwissenschaften 7

_____ (1978b) "The Hypercycle. Part C" in 65 Naturwissenschaften 341

ELLUL, Jacques (1964) The Technological Society. New York: Vintage Books

ELSTER, Jon (1978) Logic and Society - contradictions and possible worlds. Chichester: Wiley.

_____ (1980) "Cohen on Marx's Theory of History" in 28 Political Studies 121

_____ (1982) "Marxism, Functionalism and Game Theory: The case for Methodological Individualism" in 11, Theory and Society

_____(1983a) Sour Grapes. Cambridge: Cambridge University Press

_____(1983b) Explaining Technical Change. Cambridge: Cambridge University Press

_____(1985) Making Sense of Marx. Cambridge: Cambridge University Press

ENGELS, Friedrich (1881) Letter to K. Kautsky vom 1.2. 1881, in MARX-ENGELS-WERKE Bd. 35, Berlin: Dietz

_____ (1859) Letter to K. Marx in MEW 29, Berlin: Dietz, p.524

_____ (1873-83) Dialektik der Natur. In MEW 20, Berlin: Dietz

_____ (1876-8) Anti-Dühring. In Collected Works, vol. 25

_____ (1890a) Letter to Joseph Bloch, 21.-22. 9. 1890. In MEW 37:463, also in Feuer (ed.) 436

_____ (1890b) Letter to Conrad Schmidt, 27.10. 1890. In MEW 37:493; also in Feuer (ed.) 439

_____ (1893) Letter to Franz Mehring, 14.7. 1893. In MEW 39:96; also in Feuer (ed.) 446

_____ (1894) Letter to W. Borgius, 25.1. 1894. In MEW 39:205; also in Feuer (ed.) 448

ENZENSBERGER, Hans Magnus (1973) "Zur Kritik der politischen Ökologie" in (33) Kursbuch 1

EVANS, Michael (1984) "Karl Marx's first confrontation with political economy: the 1844 manuscripts" in Economy and Society 115

FEINBERG, Joel (1974) "The Rights of Animals and Unborn Generations" in W.T. Blackstone (ed.) Philosophy and Environmental Crisis. Athens (Ga.):

FETSCHER, Iring (1967) Karl Marx und der Marxismus. Von der Philosophie des Proletariats zur proletarischen Weltanschauung. München: Piper

_____ (1973) "Karl Marx on Human Nature" in 40, Social Research 443

_____ (1980) "The changing goals of socialism in the 20th century" in Social Research 36

_____ (1983) Arbeit und Spiel. Essays zur Kulturkritik und Sozialphilosophie. Stuttgart: Reclam

_____ (1985a) Überlebensbedingungen der Menschheit. Zur Dialektik des Fortschritts. München: Piper

_____ (1985b) "Technik als Weg zur Macht oder zur Freiheit?" in Gewerkschaftliche Monatshefte 513

_____ (1988) "Ein Beitrag des Rechts zur Erhaltung der natürlichen Lebensbedingungen?" in Rechtsstaat und Menschenwürde. Festschrift für Werner Maihofer zum 70. Geburtstag. Frankfurt am Main: Klostermann

FEUER, Lewis (1969) (ed.) Marx and Engels. Basic Writings on Politics and Philosophy. London: Fontana.

FEUERBACH, Ludwig (1959) Philosophische Kritiken und Grundsätze. In F. Jodl (ed.) Sämtliche Werke, Vol. II. Stuttgart: Frommann-Holzboog

_____ (1960) Erläuterungen und Ergänzungen zum Wesen des Christentums. In W. Bolin (ed.) Sämtliche Werke, Vol. VII. Stuttgart: Frommann-Holzboog

_____ (1973) Das Wesen des Christentums. In Gesammelte Werke, Band 5. Berlin: Akademie Verlag

FOERSTER, Heinz von (1984) "Principles of Self-Organization - in a Socio-Managerial Context" in H. Ulrich and G.J.B. Probst (eds.) Self-Organization and Management of Social Systems. Berlin: Springer.

FORES, Michael (1988) "Transformation and the Myth of 'Engineering Science': Magic in a White Coat" 29 Technology and Culture 62

FRASER-DARLING, Frank (1969) "Man's Rersponsibility for the Environment" in F.J. Ebling (ed.) Biology and Ethics. London:

FREUD, Sigmund (1930) Das Unbehagen in der Kultur. In Gesammelte Werke, Bd. XIV, London: Imago

FULDA, H.F. (1975) "These zur Dialektik als Darstellungsmethode" in W.R. Beyer (ed.) Hegel-Jahrbuch 1974. Köln: Pahl-Rugenstein

GALTUNG, Johan (1973) "Wachstumskrise und Klassenpolitik" in v. Nußbaum (ed.) Die Zukunft des Wachtstums. Düsseldorf:

GEHLEN, Arnold (1962) Der Mensch. Seine Natur und seine Stellung in der Welt. Frankfurt am Main/Bonn: Athenäum

GELLNER, Ernest (1987) "How did Mankind acquire its Essence? or Palaeolithic October" in W. Outhwaite and M. Mulkay (eds.) Social Theory and Social Criticism. Oxford: Blackwell

GEORGESCU-ROEGEN, Nicholas (1971) The Entropy Law and the Economic Process. Cambridge: Harvard University Press

_____ (1973) "The Entropy Law and the Economic Problem" in H. Daly (ed.) Economics, Ecology, Ethics. Essays toward a Steady State Economy. San Francisco: Freeman

GOETHE, Johann Wolfgang von (1809) Die Wahlverwandtschaften. Tübingen: Cotta

GERAS, Norman (1983a) Marx and Human Nature - The Refutation of a Legend. London: New Left Books

_____ (1983b) "Fetishism" in T. Bottomore (ed.) A Dictionary of Marxist Thought. Oxford: Blackwell

GERRATANA, Valentina (1973) "Marx and Darwin" in 82 New Left Review

GEUSS, Raymond (1981) The Idea of a Critical Theory. Cambridge: Cambridge University Press

GIDDENS, Anthony (1981) A Contemporary Critique of Historical Materialism. London: Macmillan

GIRNUS, Wilhelm (1974) "Kunsttheorie" in M. Buhr and G. Klaus (eds.) Philosophisches Wörterbuch. Leipzig: Bibliographisches Institut

GORZ, André (1973) "Technology, Technicians and Class Struggle" in A. Gorz (ed.) The Division of Labour Sussex: Harvester.

_____ (1977) Ökologie und Politik. Reinbek: Rowohlt.

_____ (1980) Abschied vom Proletariat. Frankfurt am Main: Europäische Verlagsanstalt.

_____ (1983) Wege ins Paradies. Berlin: Rotbuch.

GOULD, Stephen J. (1973) Ever Since Darwin. New York: Norton.

GRANOVETTER, Mark (1979) "The Idea of 'Advancement' in Theories of Social Evolution and Development" in 85 American Journal of Sociology 489

GROH, Dieter (1967) Marx, Engels und Darwin: Naturgeschichtliche Entwicklung oder Evolution?" reprinted in G. Altner (ed.) Der Darwinismus (1981) Darmstadt: Wissenschaftliche Buchgesellschaft

GRUHL, Herbert (1975) Ein Planet wird geplündert. Frankfurt am Main:

GRUNDMANN, Reiner (1988) Marx and the Domination of Nature. Alienation, Technology, and Communism. Florence: EUI Working Paper

HABERMAS, Jürgen (1968) Wissenschaft und Technik als Ideologie. Frankfurt am Main: Suhrkamp

_____ (1971a) Knowledge and Human Interests. Boston: Beacock

_____ (1971b) Toward a Rational Society. London: Heinemann

_____ (1973a) Legitimationsprobleme im Spätkapitalismus. Frankfurt am Main: Suhrkamp

_____ (1973b) Erkenntnis und Interesse. Frankfurt am Main: Suhrkamp

_____ (1976) Zur Rekonstruktion des historischen Materialismus. Frankfurt a.M.: Suhrkamp

_____ (1979) "Historical Materialism and the Development of Normative Structures" in Communication and the Evolution of Society. London: Heinemann

_____ (1981) Theorie des Kommunikativen Handelns. (2 vols.) Frankfurt am Main: Suhrkamp

_____ (1985) Der philosophische Diskurs der Moderne. Frankfurt am Main: Suhrkamp

HARDIN, Garret (1980) "The Tragedy of the Commons" in H. Daly (ed.) Economics, Ecology, Ethics. San Francisco: Freeman

HARICH, Wolfgang (1975) Kommunismus ohne Wachstum? Babeuf und der Club of Rome. Reinbek: Rowohlt

HAYEK, Friedrich A. von (1973-9) Law, Legislation and Liberty. (3 vols.) London: Routledge and Kegan Paul

HEGEL, Georg Wilhelm Friedrich (1952) Philosophy of Right. (T.M. Knox transl.). Oxford: Oxford University Press

_____ (1970a) Enzyklopädie der philosophischen Wissenschaften, 1. Teil. Die Wissenschaft der Logik. In Werke in 20 Bänden, H.M. Michels and E. Moldenhauer (eds.) Frankfurt am Main: Suhrkamp

_____ (1970b) Enzyklopädie der philosophischen Wissenschaften, 2. Teil. Die Philosphie der Natur. In Werke in 20 Bänden, H.M. Michels and E. Moldenhauer (eds.) Frankfurt am Main: Suhrkamp

_____ (1975) Jenaer Systementwürfe I. In Gesammelte Werke, Bd. 6. Hamburg: Meiner

_____ (1983a) Philosophie des Rechts. Die Vorlesung von 1819/20 in einer Nachschrift. D. Henrich (ed.) Frankfurt am Main: Suhrkamp

_____ (1983b) Vorlesungen über Naturrecht und Staatswissenschaft. (1817/1818) Hamburg: Meiner

HEIDEGGER, Martin (1962) Die Technik und die Kehre. Pfullingen: Neske. Translated as "The Question Concerning Technology" in D.F. Krell (Ed.) Martin Heidegger Basic Writings. (1978) London: Routledge and Kegan Paul

_____(1946/1975) "Über den Humanismus", in Gesamtausgabe Band 9. Frankfurt am Main: Klostermann

HEILBRONNER, Robert L. (1967) "Do Machines Make History?" in 8 Technology and Culture 335

_____ (1973) "Wachstum und Überleben" in v. Nußbaum (ed.) Die Zukunft des Wachtstums. Düsseldorf:

HEJL, Peter M. (1982) Sozialwissenschaft als Theorie selbstreferentieller Systeme. Frankfurt a. M.: Campus

HELLER, Agnes (1976) Theory of Needs in Karl Marx. New York: St. Martin's Press

HEMPEL, Carl G. (1965) Aspects of Scientific Explanation and other Essays in the Philosophy of Science. New York: The Free Press

HEUSER-KEßLER, Marie-Luise (1986) Die Produktivität der Natur. Schellings Naturphilosophie und das neue Paradigma der Selbstorganisation in den Naturwissenschaften. Berlin: Duncker & Humblot

HINZ, Manfred (1981) Fichtes "System der Freiheit". Analyse eines widersprüchlichen Begriffs. Stuttgart: Klett-Cotta

_____ (1985) Die Zukunft der Katastrophe - Mythische und rationalistische Geschichtstheorie im italienischen Futurismus. Berlin: de Gruyter.

HIRSCH, Fred (1976) Social Limits to Growth. Cambridge (Mass.)

HIRSCHMANN, Albert. O. (1970) Exit, Voice, Loyality. Cambridge (Mass.): Harvard University Press

HOFSTADTER, Richard (1944) Social Darwinism in American Thought. Philadelphia: Beacon Press

HONNETH, Axel (1980) "Arbeit und instrumentelles Handeln. Kategorische Probleme einer kritischen Gesellschaftstheorie" in A. Honneth und Urs Jaeggi (eds.) Arbeit, Handlung, Normativität. Theorien des Historischen Materialismus. Frankfurt a.M.: Suhrkamp

_____ (1982) "Work and Instrumental Action" New German Critique 31

_____ (1985) Kritik der Macht. Reflexionsstufen einer kritischen Gesellschaftstheorie. Frankfurt am Main: Suhrkamp

HONNETH, Axel und JOAS, Hans (1980) Soziales Handeln und menschliche Natur. Anthropologische Grundlagen der Sozialwissenschaften. New York: Campus

HORKHEIMER, Max (1968) "Bemerkungen zur philosophischen Anthropologie" in A. Schmidt (ed.) Kritische Theorie Bd. 1, Frankfurt am Main:

HORKHEIMER, Max/ADORNO, Theodor W. (1981) Dialektik der Aufklärung. GS 3, Frankfurt am Main: Suhrkamp

HOWE, Richard H. (1978) "Max Weber's Elective Affinities: Sociology within the Bounds of Pure Reason" in 84, American Journal of Sociology 366

HUDSON, Wayne (1982) The Marxist Philosophy of Ernst Bloch. London:

HUGHES, Thomas P. (1979) "Emerging Themes in the History of Technology" in 20, Technology and Culture 697

_____ (1987) "The Evolution of Large Technological Systems" in W. Bijker, Th.P. Hughes and T. Pinch (eds.) The Social Construction of Technological Systems. Cambridge (Mass.): MIT Press

HUME, David (1886) A Treatise of Human Nature. Vol. 1. Reprint 1964, Aalen: Scientia Verlag.

HUSSERL, Edmund (1970) The Crisis of European Sciences and Transcendental Phenomenology. Evanston: Northwestern University Press

ILLICH, Ivan (1973) Tools for convivality. London: Fontana

IMMLER, Hans (1984) Natur in der ökonomischen Theorie. Opladen: Westdeutscher Verlag

IMMLER, Hans und SCHMIED-KOWARZIK, Wolfdietrich (1984) Marx und die Naturfrage. Ein Wissenschaftsstreit. Hamburg: VSA

JÄNICKE, Martin (1978) Umweltpolitik. Opladen: Westdeutscher Verlag

JAY, Martin (1984) Marxism and Totality. Cambridge: Polity Press

KAUFMANN, Franz-Xaver, MAJONE, Giandomenico, OSTROM, Vincent (1986) (eds.) Guidance, Control, and evaluation in the Public Sector. Berlin: de Gruyter

KAMENKA, Eugene (1962) The Ethical Foundations of Marxism. London: Routledge & Kegan Paul

KANT, Immanuel (1788) Kritik der praktischen Vernunft. Reprint 1977 Frankfurt: Suhrkamp

KERN, Horst und SCHUMANN, Michael (1985) Das Ende der Arbeitsteilung? Rationalisierung in der industriellen Produktion - Bestandsaufnahme, Trendbestimmung. München: Beck

KEYNES, John M. (1931/1972) "Economic possibilities for our grandchildren" in Essays in Persuasion. The Collected Works of John Maynard Keynes. Vol. IX. London: Macmillan

KITSCHELT, Herbert (1984) Der ökologische Diskurs. Frankfurt am Main: Campus

KLEIN, Burton H. (1977) Dynamic Economics. Cambridge (Mass.): Harvard University Press

KLEIN, Matthäus (1974) "Humanismus" in M. Buhr and G. Klaus (eds.) Philosophisches Wörterbuch. Leipzig: Bibliographisches Institut

KLUGE, Thomas (1985) Gesellschaft, Natur, Technik. Opladen: Westedeutscher Verlag

KOLAKOWSKI, Leszek (1978) Main Currents of Marxism, vol 2 "The Golden Age", Oxford: Clarendon

KNORR-CETINA, Karin (1985) "Soziale und wissenschaftliche Methode oder: Wie halten wir es mit der Unterscheidung zwischen Natur- und Sozialwissenschaften?" in W. Bonß and H. Hartmann (eds.) Soziale Welt. Sonderband 3. Göttingen: Schwarz

KOSTA, Jiri; MEYER, Jan; WEBER, Sybille (1973) Warenproduktion im Sozialismus. Frankfurt am Main: Fischer

KRAHL, Hans Jürgen (1971) Konstitution und Klassenkampf. Frankfurt: Neue Kritik

KROHN, Wolfgang (1983) "Der Zwang zum Fortschritt" Kursbuch (73) 117

KUPILIK, Michael (1982) "The Environment and Socialism: The Soviet Model" in Barrett, N. (ed.) International Dimensions of the Environmental Crisis. Boulder (Col.): Westview

LALONDE, Brice (1978) "Kurze Abhandlung über die Ökologie" in C. Leggewie and R. de Miller (eds.) Der Walfisch. Ökologiebewegung in Frankreich. Berlin:

LA PORTE, Todd R. (1975) "Organized Social Complexity: Explication of a Concept" in T. La Porte (ed.) Organized Social Complexity. Princeton: Princeton University Press.

LAW, John (1987) "Technology and Heterogenous Engineering: The Case of Portugese Expansion" in W. Bijker, Th.P. Hughes and T. Pinch (eds.) The Social Construction of Technological Systems. Cambridge (Mass.): MIT Press

LAYTON, Edwin T. (1988) "Science as a Form of Action" 29 Technology and Culture 82

LAZONICK, WILLIAM (1979) "Industrial Realtions and Technical Change: The Case of the Self-acting Mule", Cambridge Journal of Economics 231

LEISS, William (1972) The Domination of Nature. New York: Braziller

LENIN, Wladimir I. (1917) State and Revolution. In Collected Works 25 (1974). London: Lawrence and Wishart

LENK, Hans (1982) Zur Sozialphilosophie der Technik. Frankfurt am Main: Suhrkamp

LEVINE, Andrew and Erik Olin WRIGHT (1980) "Rationality and Class Struggle" in New Left Review 47

LIFELDMAN, Heidi (1986) Living Togehter: The Rationality of Cooperation. Brown University: BA Thesis

LLOYD'S INTRODUCTION TO JURISPRUDENCE, 5th edition (1985) London: Steven & Sons

LOH, Werner (1975) "Formenanalyse bei Marx und ihr Verhältnis zur Systemwissenschaft" 4 Zeitschrift für Soziologie, 254

LOEWY, Michael (1981) "Marxism and Revolutionary Romanticism", in: 14, Telos 83-95

LUCE, Duncan and RAIFFA, Howard (1957) Games and Decisions. New York: Wiley and Sons

LUHMANN, Niklas (1970) "Funktion und Kausalität" in Soziologische Aufklärung. Opladen: Westdeutscher Verlag

_____(1980) Gesellschaftsstruktur und Semantik. Studien zur Wissensoziologie moderner Gesellschaften. Frankfurt am Main: Suhrkamp

_____(1982) "Die Voraussetzung der Kausalität" in N. Luhmann, K. E. Schorr (eds.) Zwischen Technologie und Selbstreferenz. Frankfurt am Main: Suhrkamp

_____(1983) "Evolution - kein Menschenbild" in R.J. Riedl und F. Kreuzer (eds.) Evolution und Menschenbild. Hamburg(?) Hoffmann & Campe

_____(1984a) Soziale Systeme. Frankfurt am Main: Suhrkamp

_____(1984b) "Die Wirtschaft der Gesellschaft als soziales System" in 13 Zeitschrift für Soziologie 308

_____(1984c) "The Self-Description of Society: Crisis Fashion and Sociological Theory" in 25 International Journal of Comparative Sociology 59

_____(1985) "Das Problem der Epochenbildung und die Evolutionstheorie" in H.U. Gumbrecht and U. Link-Heer (eds.)

Epochenschwellen im Diskurs der Literatur- und Sprachtheorie. Frankfurt am Main: Suhrkamp

_____(1986) Ökologische Kommunikation. Opladen: Westdeutscher Verlag

_____(1988a) "The Unity of the Legal System" in G. Teubner (ed.) Autopoietic Law: A New Approach to Law and society. Berlin: de Gruyter

_____(1988b) Closure and Openness: "On Reality in the World of Law" in G. Teubner (ed.) Autopoietic Law: A New Approach to Law and Society. Berlin: de Gruyter

_____(1988c) Positivität als Selbstbestimmtheit des Rechts. Bielefeld: Manuscript.

LUHMANN, Niklas and SCHORR, Karl-Eberhard (1982) "Das Technologiedefizit in der Erziehung und die Pädagogik" N. Luhmann and K. E. Scorr (eds.) Zwischen Technologie und Selbstreferenz. Frankfurt am Main: Suhrkamp

LUKACS, György (1923/1971) Geschichte und Klassenbewußtsein. Berlin und Neuwied: Luchterhand

LUKES, Steven (1973) Individualism. Oxford: Blackwell

_____ (1980) "Elster on counterfactuals" 23 Inquiry 145

_____ (1983) "Can the Base be distinguished from the Superstructure?" in S, Analyse und Kritik 211

_____ (1985) Marxism and Morality. Oxford: Clarendon Press

McBRIERTY, Vincent (1988) " Technology Assessment for Parliaments at National and European Level" 20 Futures 3

MACKENZIE, Donald (1984) "Marx and the Machine" 25 Technology and Culture 473

_____ (1987) "Missile Accuracy: A Case Study in the Social Processes of Technological Change" in W. Bijker, Th.P. Hughes and T. Pinch (eds.) The Social Construction of Technological Systems. Cambridge (Mass.): MIT Press

MAIHOFER, Werner (1962) "Konkrete Existenz. Versuch über die philosophische Anthropologie Ludwig Feuerbachs" Existenz und

Ordnung. Festschrift für Erik Wolf zum 60. Geburtstag. Frankfurt am Main: Klostermann

_____ (1968) Demokratie und Sozialismus. Recht und Staat im Denken des jungen Marx. Frankfurt am Main: Klostermann

MANDEL, Ernest (1975) "The generalized Recession of the International Capitalist Economy" in Inprecor, 16.1.1975

MANNHEIM, Karl (1936) Ideology and Utopia. An Introduction to the Sociology of Knowledge. London: Kegan Paul

MARCUSE, Herbert (1941/1955) Reason and Revolution. Hegel and the Rise of Social Theory. London: Routledge & Kegan Paul

_____ (1964/1967) Der eindimensionale Mensch. Neuwied: Luchterhand

MASUCH, Michael (1986) "The planning paradox" in F.Geyer and J.v.d.Zouwen (eds.) Sociocybernetic paradoxes. Beverly Hills: Sage

MATURANA, Humberto R. (1982) Erkennen: Die Organisation und Verkörperung von Wirklichkeit. Ausgewählte Arbeiten zur biologischen Epistemologie. Braunschweig: Vieweg.

MAURER, Reinhard (1973) "Natur als Problem der Geschichte" Natur und Geschichte. X. deutscher Kongreß für Philosophie. Hamburg:

MAYNTZ, Renate (1988) "Zur Entwicklung technischer Infrastruktursysteme" in R. Mayntz et. al. (eds.) Differenzierung und Verselbständigung. Frankfurt am Main: Campus

MC CARTHY, Thomas (1978) The Critical Theory of Jürgen Habermas. Cambridge, Mass.: MIT Press

McMURTRY, John (1978) The Structure of Marx's World View. Princeton: Princeton University Press

MEADOWS, Donella and Dennis (1972) The Limits to Growth. London and Sydney: Pan Books

MERRILL, Robert (1968) "Technology" article in International Encyclopedia of the Social Sciences David Sills editor. London, New York: Macmillan and The Free Press

MERTON, Robert K. (1937) "The unanticipated consequences of purposive social action" 1 American Journal of Sociology 894

_____(1968) "Manifest and Latent Functions" Social Theory and Social Structure. Second edition. New York: Free Press

MILL, John Stuart (1904) Three Essays on Religion. London:

_____(1909) Principles of Political Economy. London: Longmans, Green and Co.

_____(1974) A Systems of Logic. Ratiocinative and Inductive. London: Routledge & Kegan Paul

MISHAN, E.J. (1967) Costs of Economic Growth. London: Staples Press

MOORE, Barrington Jr. (1966) Social Origins of Dictatorship and Democracy. Boston: Beacock Press.

MOORE, Stanley (1980) Marx on the Choice between Socialism and Communism. Cambridge (Mass.) and London: Harvard University Press

MORISHIMA, Michio (1973) Marx's Economics. Cambridge: Cambridge University Press

MULKAY, Michael (1979) Science and the Sociology of Knowledge. London: Allen & Unwin

MUMFORD, Lewis (1977) Mythos der Maschine. Frankfurt am Main: Fischer

MYRDAL, Gunnar (1973) "Ökonomie einer verbesserten Umwelt" in v. Nußbaum (ed.) Die Zukunft des Wachtstums. Düsseldorf:

NAGEL, Ernst (1961) The structure of science - problems in the logic of scientific explanation. New York: Harcourt,Brace & World

NELSON, Richard, WINTER, Sidney and SCHUETTE, Herbert (1976) "Technical Change in an Evolutionary Model" in 90, Quarterly Journal of Economics 90

_____(1974) "Neoclassical vs. Evolutionary Theories of Economic Growth: Critique and Prospectus" in 84 Economic Journal 886

NEUMANN, John von (1966) The Theory of Self-Reproducing Automata. Urbana (Ill.): University of Illinois Press

NIETSCHE, Friedrich (1980) Jenseits von Gut und Böse. Werke in sechs Bänden, Band IV. K. Schlechta (ed.), München: Hanser

NORTH, Douglass C. (1986) "Is it Worth Making Sense of Marx?" in Inquiry 57

OLSON, Mancur Jr. (1965) The Logic of collective action. Cambridge (Mass.): Harvard University Press

PARSONS, Talcott und Edward A. SHILS (1951) (Eds.) Toward a General Theory of Action. Theoretical Foundations for the Social Sciences. New York: Harper & Row.

PASSMORE, John (1974) Man's Responsibility for Nature. London: Duckworth

PERROW, Charles (1984) Normal Accidents. New York: Basic Books

PETROVIC, Gajo (1983) articles "Alienation" and "Reification" in T. Bottomore (ed.) A Dictionary of Marxist Thought. Oxford: Blackwell

PIGOU, Arthur (1932) The Economics of Welfare. London: Macmillan

PINCH, Trevor and Wiebe BIJKER (1987) "The Social Construction of Facts and Artifacts: Or how the Sociology of Science and the Sociology of Technology Might Benefit Each Other" in W. Bijker, Th.P. Hughes and T. Pinch (eds.) The Social Construction of Technological Systems. Cambridge (Mass.): MIT Press

PIORE, Michael and SABEL, Carles (1984) The Second Industrial Divide. New York: Basic Books

PIZZORNO, Alessandro (1986) "Some other Kind of Otherness: A Critique of 'Rational Choice' Theories" in A. Foxley, M. McPherson (eds.) Development, Democracy, and the Art of Trespassing. Notre Dame (Indiana): University of Notre Dame Press

PLEMENATZ, J. (1975) Karl Marx' Philosophy of Man. Oxford: Clarendon Press

POLANYI, Karl (1944) The Great Transformation. Boston: Beacock Press

PREUSS, Ulrich K. (1981) "Die Zukunft: Müllhalde der Gegenwart?" in Freibeuter

_____ (1984a) "Über Grenzen und Möglichkeiten kollektiver Rationalität" in Die Linke neu denken. Acht Lockerungen. Berlin: Wagenbach

PRICE, D.J. de Solla (1982) "The parallel structures of science and technology" in B. Barnes, D. Edge (eds.) Science in Context. Milton Keynes: Open University Press

RAMMERT, Werner (1988) "Technikgenese. Stand und Perspektiven der Sozialforschung zum Entstehungszusammenhang neuer Techniken" 40 Kölner Zeitschrift für Soziologie und Sozialpsychologie 747

RAPP, Friedrich (1978) Analytische Technikphilosophie. Freiburg/München: Alber

RAWLS, John (1972) A Theory of Justice. Oxford: Oxford UP

REGAN, T. and SINGER, P. (1976) Animal Rights and Human Obligations.

REICHE, Jochen (1984) "Ökologie und Zivilisation. Der Mythos von den 'natürlichen Kreisläufen'." in Die Linke neu denken. Acht Lockerungen. Berlin: Wagenbach

RICOEUR, Paul (1986) Lectures on Ideology and Utopia. George H. Taylor (ed.) New York: Columbia University Press

ROBINSON, Joan (1962) Economic Philosophy. Harmondsworth: Penguin

ROEMER, John E. (1981) Analytical Foundations of Marxian Economic Theory. Cambridge: Cambridge University Press

ROSDOLSKY, Roman (1968) Zur Enstehungsgeschichte des Marxschen 'Kapital'. Frankfurt: Europäische Verlagsanstalt.

ROSENBERG, Nathan (1976a) "The direction of technological change: inducement mechanisms and focusing devices" Perspectives on Technology. London, New York, Melbourne: Cambridge University Press

_____ (1976b) "Karl Marx on the economic role of science" in Perspectives on Technology. London, New York, Melbourne: Cambridge University Press

_____ (1982a) "Marx as a student of technology" Inside the black box: Technology and Economics. Cambridge: Cambridge University Press

_____ (1982b) "How exogenous is science?" Inside the Black Box: Technology and Economics. Cambridge: Cambridge University Press

ROSENBLADT, Sabine (1986) Der Osten ist grün? Ökoreportagen aus der Sowjetunion, Tschecoslowakei, Polen, Ungarn. Hamburg: Rasch und Röhring

ROTTLEUTHNER, Hubert (1988) "Biological Metaphors in Legal Thought" in G. Teubner (ed.) Autopoietic Law: A New Approach to Law and Society. Berlin: de Gruyter

RUBEL, Maximilien (1980) Marx, his Life and his Works. London:

SANTOS, Boaventura de Sousa (1984) On Modes of Production of Social Power and Law. Madison: University of Wisconsin-Madison Law School Working Papers

SCHEFOLD, Bertram (1977) "Energy and Economic Theory" in 7 Zeitschrift für Wirtschafts- und Sozialwissenschaften 227

SCHELER, Max (1980) Die Wissensformen und die Gesellschaft. In Gesammelte Werke, Bd. 8. Bern: Francke

SCHELLING, Friedrich W.J. (1797) "Ideen zu einer Philosophie der Natur" in Schellings Werke, Bd. 1, M. Schröter (Hg.), München: C.H. Beck'sche Verlagsbuchhandlung

_____ (1798) "Von der Weltseele, eine Hypothese zur höheren Physik" in Schellings Werke, Bd. 1, M. Schröter (Hg.), (1927) München: C.H. Beck'sche Verlagsbuchhandlung

SCHLUCHTER, Wolfgang (1981) The Rise of Western Rationalism. Berkeley: University of California Press

SCHMIED-KOWARZIK, Wolfdietrich (1984) Das Dialektische Verhältnis des Menschen zur Natur. Philosophiegeschichtliche Studien zur Naturproblematik bei Karl Marx. Freiburg: Alber

SCHMIDT, Alfred (1971) Der Begriff der Natur in der Lehre von Karl Marx. Frankfurt am Main: Europäische Verlagsanstalt

SCHUFFENHAUER, Werner (1965) Feuerbach und der junge Marx. Berlin: Deutscher Verlag der Wissenschaften

SCHUMPETER, Joseph A. (1932) Capitalism, Socialism and Democracy.

SEIDEL, Ch. (1972) "Fetischismus" in Historisches Wörterbuch der Philosophie. Basel: Schwabe & Co.

SELUCKY, Radoslav (1979) Marxism, Socialism, Freedom. New York: St.Martin's Press

SEN, A.K. (1967) "Isolation, Assurance and the Social Rate of Discount" 81, Quarterly Journal of Economics 112; reprinted in Resources, Values and Development. (1984) Oxford: Blackwell

_____ (1982) Choice, Welfare and Measurement. Oxford: Blackwell

SENGHAAS, Dieter (1974) in H.E. Richter (ed.) Wachstum bis zur Katastrophe? Stuttgart: Deutsche Verlagsanstalt

SHAW, William H. (1984) "Marxism, Revolution, and Rationality" in T. Ball, J. Farr (eds.) After Marx Cambridge: Cambridge University Press

_____(1986) "Historical Materialism and the Development Thesis" in 16 Philosophy of the Social Sciences 197

SKOCPOL, Theda (1973) "A critical Review of Barrington Moore's Social Origins of Dictatorship and Democracy" in 4 Politics and Society 1

SMITS, Ruud and LEYLEN, J. (1988) "Key issues in the Institutionalisation of Technology Assessment" 20, Futures 19

STEEDMAN, Ian (1977) Marx after Sraffa. London: New Left Books

STEINVORTH, Ulrich (1977) Eine analytische Interpretation der Marxschen Dialektik. Meisenheim am Glan: Hain.

STICHWEH, Rudolf (1987) "Die Autopoiesis der Wissenschaft" in D. Baecker et.al. (eds.) Theorie als Passion. Frankfurt a.M. Suhrkamp

STONE, Cristopher (1974) Should Trees have a Standing? New York: Avon Books

STRASSER, Johano und TRAUBE, Klaus (1981) Die Zukunft des Fortschritts. Der Sozialismus und die Krise des Industrialismus. Bonn: Verlag Neue Gesellschaft

SZTOMPKA, Piotr (1974) System and Function: Toward a Theory of Society. New York: Academic Press

TAYLOR, Charles (1975) Hegel. Cambridge: Cambridge University Press

_____ (1979) Hegel and Modern Society. Cambridge: Cambridge University Press

_____ (1985) "Social Theory as Practice" in Philosophy and the Human Sciences. Cambridge: Cambridge University Press

TEUBNER, Gunther (1987) "Episodenverknüpfung. Zur Steigerung von Selbstreferenz im Recht" in D. Baecker et al. (eds.) Theorie als Passion. Frankfurt am Main: Suhrkamp

_____ (1988a) "Introduction to Autopoietic Law" in G. Teubner (ed.) Autopoietic Law: A New Approach to Law and Society. Berlin: de Gruyter

_____(1988b) "Evolution of Autopoietic Law" in G. Teubner (ed.) Autopoietic Law: A New Approach to Law and Society. Berlin: de Gruyter

_____(1989a) "How the Law thinks" * Law and Society Review

_____(1989b) Recht als autopoietisches System. Frankfurt am Main: Suhrkamp

TEUBNER, Gunther, WILLKE, Helmut (1984) "Kontext und Autonomie - gesellschaftliche Selbststeuerung durch reflexives Recht" 5 Zeitschrift für Rechtssoziologie 4

THEUNISSEN, Michael (1975) "Krise der Macht. Thesen zur Theorie des dialektischen Widerspruchs". Hegel-Jahrbuch 1974. W.R. Beyer (ed.) Köln:Pahl Rugenstein, p 318-329

_____(1978) Sein und Schein. Frankfurt am Main: Suhrkamp

TIEZZI, Enzo (1984) Tempi storici, tempi biologici. Milano: Garzanti

TREPL, Ludwig (1983) "Ökologie - eine grüne Leitwissenschaft? Über Grenzen und Perspektiven einer modernen Disziplin" Kursbuch (74)

TRIBE, Laurence H. (1976) "Ways not to think about Plastic Trees" in L.H. Tribe, C.S. Schelling, J. Voss (eds.) When Values Conflict. Essays on Environmetal Analysis, Discourse and Decision. Cambridge (Mass.):

TROTSKY, Leon (1936) Verratene Revolution. (1971) Berlin: Verlag die Vierte Internationale

TUCKER, Robert (1961) Philosophy and Myth in Karl Marx. Cambridge: Cambridge University Press

TUINIGA, E.J. (1988) "Technology Assessment in Europe" 20 Futures 37

Ullrich, Otto (1979) Weltniveau. In der Sackgasse des Industriesystems. Berlin: Rotbuch

URE, Andrew (1835) The Philosophy of Manufacturers. London: Knight

VAN DEN BERGHE, Pierre (1963) "Dialectic and Functionalism: Toward a Theoretical Synthesis" 28 American Sociological Review 695

VAN PARIJS, Philippe (1981) Evolutionary Explanation in the Social Sciences. An Emerging Paradigm. London and New York: Tavistock

_____ (1983) "The Shifting Primacy Puzzle" in 5, Analyse und Kritik 223

_____ (1984) "Marxism's Central Puzzle" in After Marx. T. Ball and J. Farr (eds.) Cambridge: Cambridge University Press

VECA, Salvatore (1977) Saggio sul programma scientifico di Marx. Milano: Il Saggiatore

VICTOR, Peter A. (1980) "Economics and the Challenge of Environmental Issues" in H. Daly (ed.) Economics, Ecology, Ethics. San Francisco: Freeman

von MAGNIS, Franz (1975) Normative Voraussetzungen im Denken des jungen Marx. Freiburg: Alber

WALDRON, Jeremy (1984) "Introduction" Theories of Rights. (J. Waldron ed.) Oxford: Oxford University Press

WARTOFSKY, Marx W. (1977) Feuerbach. Cambridge: Cambridge University Press

WEBER, Max (1905) "Die protestantische Ethik und der 'Geist' des Kapitalismus" in 20 Archiv für Socialwissenschaft und Socialpolitik 1

_____ (1930) The Protestant Ethic and the Spirit of Capitalism. Transl. T. Parsons. London: Allen & Unwin

_____ (1948) "Politik als Beruf", translated in H. Gerth and C.W. Mills (eds.) From Max Weber. Essays in Sociology. London: Routledge and Kegan Paul

_____ (1972) Wirtschaft und Gesellschaft, Bd.1. Tübingen: Mohr

_____ (1978) Economy and Society. Berkeley: University of California Press

WEICK, Karl E. (1979) The Social Psychology of Organizing. (Second edition) Reading (Mass.): Addison-Wesley.

WELSKOPF, Elisabeth (1974) "Schauplatzwechsel und Pulsation des Fortschritts" in E. Schulin (ed.) Universalgeschichte. Köln: Kiepenheuer & Witsch.

WILLIAMS, Bernard (1985) Ethics and the Limits of Philosophy. London: Fontana

WINNER, Langdon (1975) "Complexity and the Limits of Human Understanding" in T. La Porte (ed.) Organized Social Complexity. Princeton: Princeton University Press.

_____ (1977) Autonomous Technology. Technics-out-of-Control as a Theme in Political Thought. Cambridge (Mass.): MIT Press

WOOD, Allen W. (1980) "The Marxian Critique of Justice", in: Cohen, M. et al.

_____ (1980) "Marx on Right and Justice: A Reply to Husami", in COHEN, Marshall; Thomas NAGEL, and Thomas SCANLON, (eds.) Marx, Justice and History. Princeton: Princeton University Press
et al.

WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT (1987) Our Common Future. Oxford: Oxford University Press

ZOLO, Danilo (1974) La teoria communista dell'estinzione dello Stato. Bari: De Donato

_____ (1988) "The epistemological Status of the Theory of Autopoiesis and its Application to the Social Sciences" in G. Teubner (ed.) State, Law, Economy as Autopoietic Systems. Berlin: de Gruyter